

NEW

HISTORY OF THE

UNITED STATES ★ AIR FORCE

OVER 100 YEARS
OF AERONAUTICAL
& MILITARY
TECHNOLOGY



FROM THE MAKERS OF
HISTORY
WAR
★

★ THE INSIDE STORY OF ★

America's heroes
OF THE AIR

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HEROES & VETERANS ★ AMAZING INVENTIONS ★ COMBAT OPERATIONS ★ & MORE



WELCOME

It started with a Union Army observation balloon above the First Battle of Bull Run in 1861. It would go on to become the world's largest air force, tasked with achieving and maintaining American air supremacy through intelligence, technology, mobility and strike capability. The US Air Force is a globally renowned behemoth: fast, deadly, and with a worldwide reach. It has waged war and kept the peace in combat zones around the world. Its highly trained pilots have flown record-breaking missions, some literally out of this world. Its associated engineers, crew and ground staff continue to invent, create and maintain incredible and sometimes top-secret technologies. Discover the pilots, planes, and heroic stories of the US Air Force, from its earliest beginnings during the American Civil War through decades of global conflicts in which it has always fulfilled its mission to secure and protect the USA's airspace, its interests, its allies, and the American way of life.



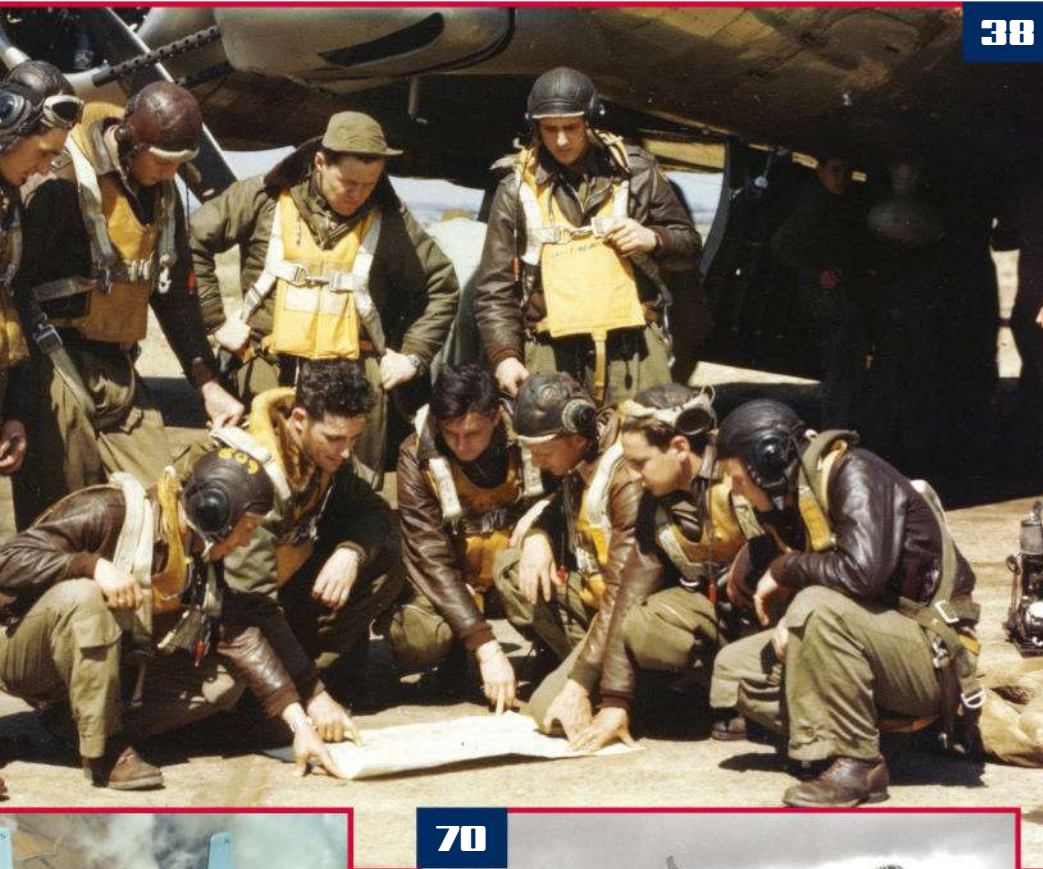


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AIM HIGH... FLY-FIGHT-WIN

The US Air Force, created officially in 1947, continues as a frontline component of **MILITARY DEFENCE** for the United States and the free world

★ WORDS: MICHAEL E HASKEW ★





he creation of the United States Air Force on 18 September 1947 was a logical milestone in the evolution of American military air power.

Advancing technology inevitably found military applications in the early 20th century, and within a decade of the famed Wright Brothers flight at Kitty Hawk, the expectation that air operations would become a component of future armed conflict was not lost on the US War Department or the leaders of the armed services.

In fact, the use of air assets by the US armed forces had actually begun with the deployment of reconnaissance balloons by the Union Army during the Civil War of 1861-65. While these balloons were tethered to the ground and subject to shifting winds, powered flight was a tantalising prospect, and that goal was realised less than 40 years after the Civil War ended. The Army recognised the requirement that air assets should become available in a reasonable period of time; however, the exact role of the aircraft would become a subject of debate.

Nevertheless, the Aeronautical Division of the Army Signal Corps was established on 1 August 1907, followed by the Aviation Section of the Signal Corps on 18 July 1914, and the progression through the Division of Military Aeronautics and US Army Air Service into the 1920s. The US Army Air Corps existed from 1926 through June 1941, when the US Army Air Forces was established. The Army Air Forces was then succeeded by the US Air Force with the National Security Act of 1947. Thus, from inception to operational and administrative independence the US Air Force emerged in its own right after four decades and having rendered outstanding service in two world wars.

To date, the most extensive use of American military air power occurred during World War II as 2.4 million men and women served at peak strength and 68,000 personnel gave their lives in the great struggle in theatres of conflict from Europe to North Africa, the Pacific and the Asian continent. Comparatively, such strength dwarfed the commitment to the Great War, which the US entered in the spring of 1917. By the end of World War I, the air service numbered just 195,000. Even so, the spectacle of intrepid pilots and planes made of wood and canvas locked in aerial death struggles was a harbinger of things to come.

The story of US Air Force fixed-wing flight began in 1908, just five years after Orville and Wilbur Wright went aloft on that windswept beach in North Carolina. Preliminary testing had begun in February, but Lieutenant Thomas Selfridge had been killed in a crash that September. The tragedy sent the Wright Brothers back to their design boards, and when the improved aircraft was presented, the future of American military aviation was sealed.

Without doubt, the US military establishment was committed to the development of a third dimension of warfare – ground and seaborne, and now in the skies.

The Army purchased a single Wright-built aircraft in the summer of 1909, promptly naming the plane the Wright Military Flyer and officially designating the machine as Signal Corps Airplane No 1. The cost was \$30,000, and the plane was accepted into service in August after undergoing a series of field trials. With an eye toward its own history, the Army donated the used Wright Flyer to the Smithsonian Institution in 1911.

Even as Army aviation was in its infancy, the US Navy also initiated an aviation program. Within each branch of service, a vigorous deliberation ensued as to the future of air



The US Air Force was established by the National Security Act of 1947 as a separate branch of the US military

power and its role in the skies above the battlefield and across the oceans in the 20th century. As for the Army, the discourse centred on the use of the aircraft purely for reconnaissance purposes or its application as an offensive weapon, capable of firing small arms in strafing ground targets, dogfighting with enemy planes and dropping bombs on identified targets on the front lines and even miles beyond in enemy territory.

From a strategic standpoint, there were those whose dark vision conjured up images of massive 'terror bombing' raids against civilian populations, with horrific loss of life as a result. Through the years during and after World War I, such worries were similar to those voiced



A US A10 Thunderbolt attack aircraft, affectionately known as a Warthog, demonstrates ground strike capabilities as utilised against modern battlefield targets

during the nuclear age and the Cold War a half century later.

By the end of World War II, some of those stark images had been realised with great cities laid waste. Fleets of bombers had dropped their cargoes of destruction, while fighters had slashed through the skies in single combat and ravaged those very bomber formations. To end the war in the Pacific, the US Army Air Forces sent bombers aloft to deliver the most destructive weapons yet seen on Earth: the atomic bombs that devastated Hiroshima and Nagasaki.

When World War II ended in 1945, the US had fielded 80,000 Army aircraft. General Henry 'Hap' Arnold, commanding the US Army Air Forces, concluded, "Offense is the essence of air power."

Since its inception, the mission of the US Air Force has remained constant. Its charge in 1947 was summed up in the Congressional act that created it. "In general, the United States Air Force shall include aviation forces both combat and service not otherwise assigned. It shall be organised, trained and equipped primarily for prompt and sustained offensive and defensive air operations. The Air Force shall be responsible for the preparation of the air forces necessary for the effective prosecution of war except as otherwise assigned and, in accordance with integrated joint mobilisation plans, for the expansion of the peacetime components of the Air Force to meet the needs of war."

In short, the US Air Force is an instrument of war that functions at all times to maintain preparedness for the eventuality of war. In that process, five components are continually monitored, assessed and reinvigorated. These include air superiority, global integrated intelligence, surveillance and reconnaissance (ISR), rapid global mobility, global strike capability and command and control.

Each of these pillars is critical to the success of the overall military deployment, whatever it may be. Air superiority simply means that

**"SINCE ITS INCEPTION,
THE MISSION OF THE US AIR FORCE
HAS REMAINED CONSTANT"**



Air Force to Space Force

The United States Air Force effectively gave rise to the United States Space Force, established on 20 December 2019. The Space Force functions under the auspices of the Department of the Air Force, as a separate but equal uniformed service. The Space Force was created as an extension of the Air Force Space Command (AFSPC) formed in 1982 and originally known as Space Command (SPACECOM).

Since its inception, the Space Force has grown to include approximately 9,400 active duty men and women. Its mission is to comprehensively support the United States in the frontiers of space, particularly to guarantee freedom of US operations in space, conduct US operations in space and to protect the interests of the US in space. The leadership of the Space Force further defines its mission in three active components: exercising space superiority, performing global operations in space and assuring that the nation has perpetual access to space.

General B Chance Saltzman currently serves as the Chief of Space Operations and is the highest ranking uniformed officer in the Space Force. His responsibilities encompass all aspects of the service's duties. He advises the President on space-related matters and oversees through subordinate officers three major commands, including Space Systems Command, Space Operations Command and Space Training and Readiness Command.

Above: This 2023 launch of a SpaceX Falcon Heavy rocket was executed under Space Force auspices

related military operations on land, sea and air may take place without the threat of imminent attack by enemy planes on the tactical or strategic level. To achieve air superiority, the latest in ISR must be honed to razor sharpness and readily available without technical interruption or failure. The Air Force must be mobile, either from bases in the United States or forward in locales around the globe – able to reach combat zones rapidly and intervene decisively. The US capability in weaponry and global reach must be unmatched by any other military power in the world, while command and control bring efficiency and minimise risk where possible.

Through the post-World War II era, into the half-century Cold War with the conflicts in Korea and Vietnam as litmus tests of American air capabilities along the way, the Air Force has achieved major victories and learned difficult lessons at the same time, improving its tactics and hardware in the face of opposing countermeasures, including the latest generation of fighter and bomber aircraft produced by the Soviet Union and its successor states such as the Russian Federation, as well as the rising People's Republic of China.

Committed to global hot spots in the Balkans, during the Gulf War of 1990-91, the invasion of Iraq in 2003 and intermittent peacekeeping and enforcement actions around the world, the US Air Force constitutes the cutting edge of military might. Beginning in

the 1960s, the Air Force began experimenting with unmanned aerial vehicles (UAV), and by the 1990s its expertise in the deployment of drones for combat and surveillance purposes was unsurpassed. At the same time, its use of stealth technology has dazzled the world, including long-range air strikes and refinement of structural attributes.

With respect to the provisions of the Constitution, control of the US Air Force resides with the civilian government, the President of the United States, Secretary of War and Secretary of the Air Force. Today, nine separate commands bear responsibility for the ongoing operations and readiness of the Air Force to fulfil its complex mission. These commands are led on a daily basis by the Chief of Staff of the Air Force, four-star General Kenneth Wilsbach, who supervises all units and serves as a member of the Joint Chiefs of Staff. Officer rank structure is identical to that of the US Army from second lieutenant through five-star General of the Air Force (now vacant and designated only during wartime). Enlisted ranks follow a progression from Airman Basic through Chief Master Sergeant of the Air Force, the primary advisor to the Secretary of the Air Force and Chief of Staff on matters concerning the enlisted ranks.

The US Air Force today includes 314,000 active duty personnel and a reserve component of 174,000. Operations are conducted from 59 bases in the United States and more than 120 locations around the world.

**"CONTROL OF THE US AIR FORCE RESIDES WITH THE CIVILIAN
GOVERNMENT, THE PRESIDENT OF THE UNITED STATES,
SECRETARY OF WAR AND SECRETARY OF THE AIR FORCE"**



The US Air Force aims to be the best-equipped and most lethal air fighting force in the world in order to protect America



★ **AIM HIGH...**
FLY-FIGHT-WIN



This recruiting poster for the US Army Air Forces was created during the World War II years and romanticised the service



Images: Getty, Wiki



AERONAUTICS AND AVIATORS

The earliest stirrings of a **DEDICATED US AIR FORCE** occurred during the Civil War and steadily grew at the turn of the 20th century

★ WORDS: MICHAEL E HASKEW ★



pen scepticism greeted Professor Thaddeus Lowe when he proposed an “observation balloon” to observe Confederate troop dispositions and movements during the pivotal First Battle of Bull Run in the American Civil War. However, his reports were informative, and Union officers were more convinced of the value of aerial reconnaissance. More importantly, they had unknowingly witnessed the birth of the US Air Force. Lowe’s Union Army Balloon Corps came into being in October 1861 and was manned entirely by civilians. For the next two years, Union balloons went aloft, hovering over battlefields, sometimes being shot at by Confederate soldiers and their own troops as well, and gathering information.

The prospect of flight was nothing new, having tantalised mankind for centuries. However, the notion that heavier-than-

air structures might take men aloft was an illusory dream until 1903, when the Wright Brothers briefly soared to lasting fame. No doubt, the military-minded quickly grasped the potential for aircraft to participate in wartime. The American military establishment rapidly embraced the prospect and purchased a single Wright Flyer in 1909 to further its investigation into air power.

In August 1907, the US Army had established the Aeronautical Division of the Signal Corps, the tie between the aircraft and the section extending from Professor Lowe’s association with signals during the Civil War. Into this burgeoning and romanticised component of the service, the earliest US Army aviators were inducted. By the autumn of 1912, the Aeronautical Division had grown to 11 planes, nine of them operational with one having been lost in an accident. The first organised permanent aviation unit in American history was commissioned the following year. The 1st Aero Squadron, formed in February 1913, included 53 pilots – 51 of them officers and

two enlisted – and 30 aircraft, while 13 pioneering airmen had been lost in accidents during its tenure.

On 18 July 1914, the Congress created the Aviation Section of the Signal Corps, which inherited the assets of the Aeronautical Division. Lawmakers had only recently declined to create a separate air force at that time. The actual establishment of a separate air force was destined not to take place until 33 years later. The Aviation Section was the primary air arm of the American military, and General Order No 10 organized the 1st Aero Squadron into two operational companies with a total of 16 officers and 90 enlisted airmen. The squadron included seven serviceable aircraft.

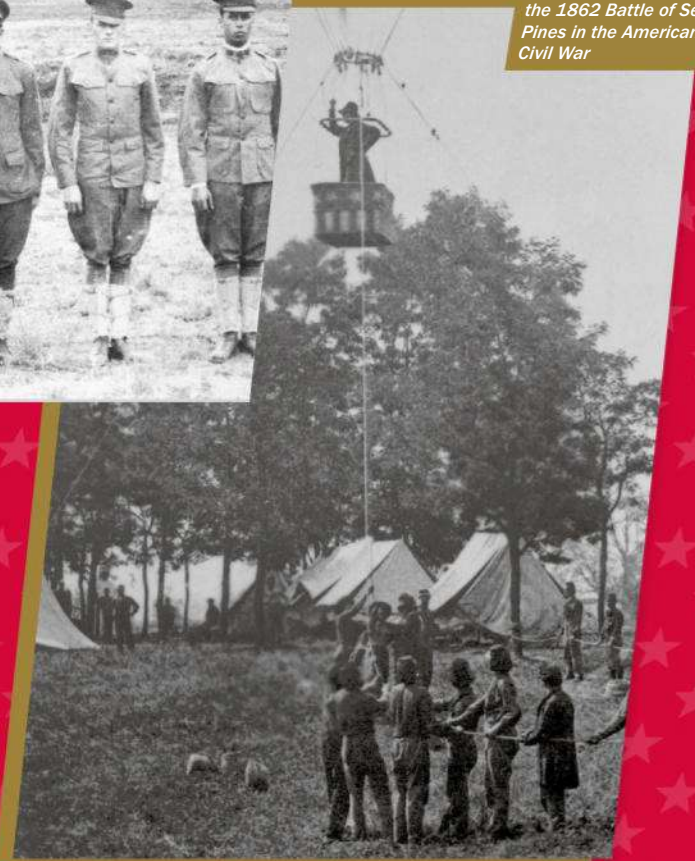
At the same time, the 1st Aero Squadron had been engaged on a provisional basis in air operations along the country’s southwestern border as tensions with Mexico aroused rumours of possible military action. This deployment constituted the first engagement of a dedicated air service unit in the history of the United States military.

The first Wright Military Flyer arrives at Fort Myer, Virginia, in September 1908, to begin flight trials with the Aeronautical Division



Airmen of the 1st Aero Squadron pause from intensive training for a photograph with one of their planes in the background

Professor Thaddeus Lowe ascends in his balloon named Intrepid during the 1862 Battle of Seven Pines in the American Civil War



Images: Wiki



HEROES OF THE MEDAL OF HONOR

Eddie Rickenbacker

*Proving he wouldn't ask his pilots to do anything he wouldn't do himself, this lieutenant flew a solo mission over Billy, France, on **25 SEPTEMBER 1918**, taking on **SEVEN ENEMY PLANES***

★ WORDS: MURRAY DAHM ★



To prove to the men of his 94th Aero Squadron that he was one of them, Lieutenant Eddie Rickenbacker took to the air alone on 25 September, 1918, over

Billy, France. Spotting seven enemy planes – five Fokker D.VIIs protecting two Halberstadt CL.IIs – Rickenbacker, disregarding the odds, attacked without hesitation and fired on the enemy formation. Diving through the German planes, he downed one of the Fokkers and one of the Halberstadts and returned home. For this action he was awarded his eighth (a record) Distinguished Service Cross, and in 1931 President Herbert Hoover awarded him the Medal of Honor for this action.

By the time of America's entry into World War I in April 1917, Rickenbacker was already a household name. Obsessed with engines, he had become a mechanic to the racing driver Lee Frayer in the 1906 Vanderbilt Cup at the age of only 15. In 1910 he became a race-car driver himself, taking part in the Indianapolis 500 in 1911. Rickenbacker joined the Duesenberg brothers to develop a new Mason racing car with which he achieved national fame in 1914, becoming known as 'Fast Eddie' for his hard driving and his daring – skills he would utilise as a pilot. He set a world land speed record at Daytona in 1914 of 215km/h

(134mph). He came close to being the champion driver in 1916. That year he signed on to the British Sunbeam team and sailed to the UK, despite the war. He was detained in Liverpool, suspected of being the son of a disowned Prussian baron, but a newspaper had invented these 'facts'. He was, in fact, the third son of Swiss-German Ohio immigrants. However, he soon abandoned the original spelling of his name, Rickenbacher.

Rickenbacker had already shown some interest in aviation (his first flight was in 1916) and his time in England reinforced that interest. He suggested making a flying squadron out of racing car drivers, men who were experts in motors and speed. Rickenbacker volunteered as soon as America entered WWI, despite the fact he was earning an estimated \$40,000 a year as a racing driver. Rickenbacker arrived in France as the chauffeur to Major Townsend F Dodd, the first commissioned US Army aviator. Fixing a broken motor, Rickenbacker also impressed Lieutenant Colonel Billy Mitchell (the man regarded as the father of the United States Air Force). Rickenbacker may have pestered both these aviators to give him a chance in the air. First, however, he was asked to become the chief engineer at the flight school at Issoudun Aerodrome, the largest airbase in the world at the time, where US airmen were trained before leaving for the front. Rickenbacker seized his chance and undertook

flight training – possibly lying about his age, claiming to be 25 (the upper limit). He was in fact 26. He received five weeks training, with a total of 25 air hours, in September 1917 and was commissioned as a lieutenant.

Rickenbacker's fellow trainees considered him uncouth and out of place. Most pilots were college students and the rough, brusque Ohioan was shunned, despite his expertise. He was also over age and had no college degree (a requirement), but still he persisted. By March, Rickenbacker had finished gunnery training and moved to the Villeneuve-les-Vertus Aerodrome. There he was mentored by Major Raoul Lufbery, a fighter ace who had served with the French Air Force before serving with the United States Army Air Service from 1917. The newly established 94th Aero Squadron, the 'Hat-in-the-ring' gang, was led by Lufbery flying Nieuport 28 fighters, although many lacked armament. Rickenbacker's first combat patrol, on 6 March 1918, was with Lufbery and another pilot; only Lufbery's plane had guns. Rickenbacker made his first sortie on 13 April and on 29 April shot down his first enemy plane. The man who accompanied Rickenbacker and Lufbery on 6 March was Lieutenant Douglas Campbell – he shot down his first enemy on 14 April and became America's first 'ace' of the war.

By 28 May (less than a month after his first victory) Rickenbacker had shot down his fifth

"WHILE ON A
VOLUNTARY PATROL
OVER THE LINES,
LIEUTENANT
RICKENBACKER
ATTACKED SEVEN
ENEMY PLANES...
DISREGARDING THE
ODDS AGAINST HIM,
HE DIVED ON THEM..."

Medal of Honor citation, 1931

*Captain Rickenbacker with
his Medal of Honor in 1931*





enemy plane, earning his 'ace' status. He was awarded the Croix de Guerre. Later he would be awarded the first of his eight Distinguished Service Crosses for his victory on 29 April (his actions on 25 September were also later awarded the Medal of Honor). By that time in May, however, Lufbery had died on the 19th, and Rickenbacker was sick with an abscess. During his convalescence, Rickenbacker reflected that he needed to be less foolhardy as a pilot and more disciplined. Returning to active duty in September 1918, the squadron was now equipped with reliable Spad XIII's and Rickenbacker's tally began to rise. A new commander was needed for the squadron and 27-year-old Lieutenant Rickenbacker was chosen on 24 September. To show he was a leader who would never abandon his pilots or ask them to do something he wasn't willing to do himself, Rickenbacker went up alone on 25 September over Billy.

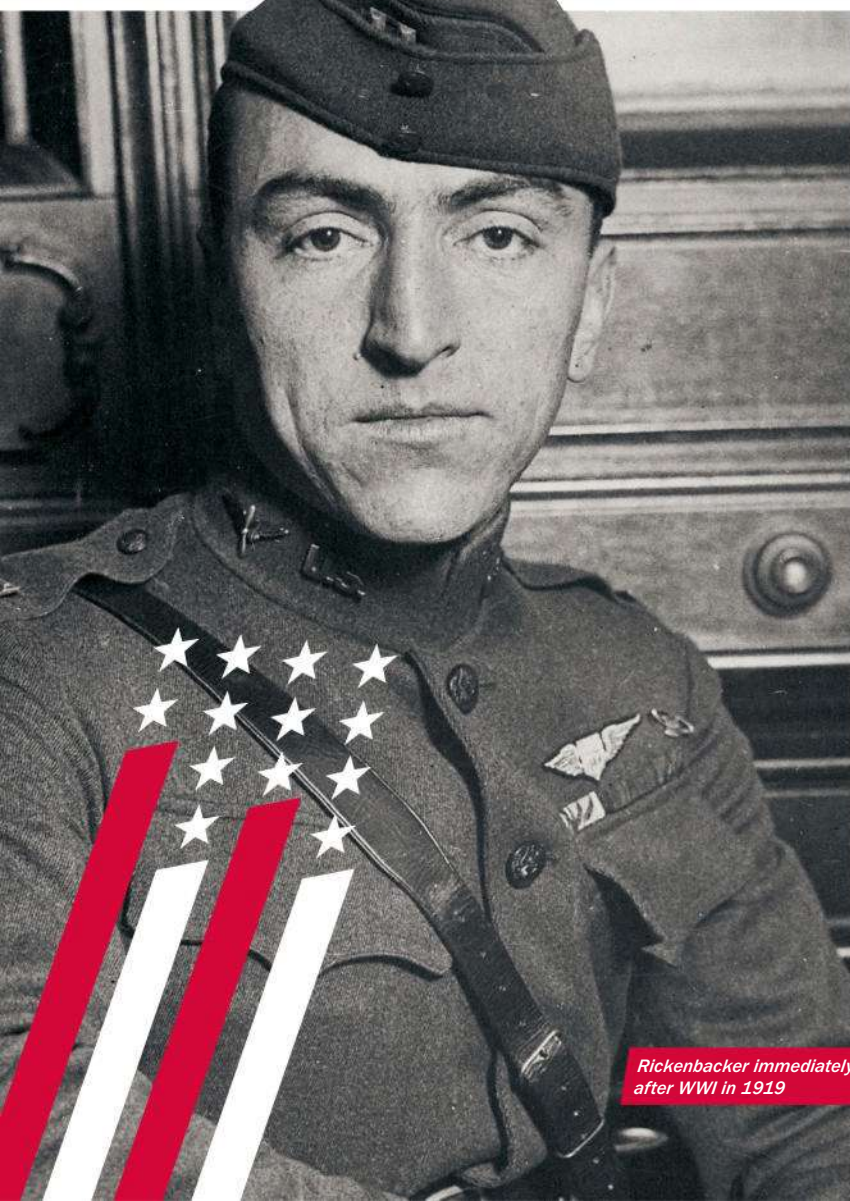
In total, Rickenbacker achieved a tally of 26 victories, making him the 'Ace of Aces' for the United States during WWI. His tally would not be exceeded by an American pilot until Captain Richard Bong on 12 April, 1944 (Bong

**"I WAS THE ONLY AUDIENCE
FOR THE GREATEST SHOW EVER
PRESENTED. ON BOTH SIDES OF
NO MAN'S LAND, THE TRENCHES
ERUPTED. BROWN-UNIFORMED
MEN POURED OUT OF THE
AMERICAN TRENCHES, GRAY-
GREEN UNIFORMS OUT OF THE
GERMAN. FROM MY OBSERVER'S
SEAT OVERHEAD, I WATCHED
THEM THROW THEIR HELMETS IN
THE AIR, DISCARD THEIR GUNS,
WAVE THEIR HANDS"**

Rickenbacker in 1967

would be America's top ace of WWII, with 40 victories). Rickenbacker still ranks as the USA's tenth top ace of all time. Rickenbacker's last 14 victories were achieved in October 1918, during which he was promoted to captain. Confirmation of victories was needed and several did not come for some time (even after the war). Rickenbacker's first solo victory (on 7 May, 1918) wasn't confirmed until another pilot (James Hall) who had been shot down and captured later in the same flight was released. Rickenbacker did not like his title of 'Ace of Aces' – it had been given out with much fanfare to pilots during the war and the three previous holders, Lufbery, David Putnam and Frank Luke, had all been shot down and killed. Rickenbacker's luck, however, would continue to hold.

Soon the 94th squadron was taking out observation balloons to 'blind the eyes of the enemy', and as proof of his leadership several of Rickenbacker's men downed more of them than he did. Rickenbacker, however, flew more missions and had more hours in the air than his men, amassing 300 combat hours and 134 'dogfights'. He had several rules for his fliers to ensure their success and survival – he approached his enemies carefully and got



*Rickenbacker immediately
after WWI in 1919*

*A modern replica of a Spad XIII
in the colours of Rickenbacker's
94th Aero Squadron*



*Issoudun Aerodrome in 1918,
where Rickenbacker received
only five weeks training – a total
of 25 hours flying time*



Rickenbacker in his Spad XIII, in which he scored the majority of his victories



up close before opening fire. He encouraged his men to only attack if they had at least a 50 per cent chance of success, and to break for home if necessary. He held meetings with his pilots to discuss tactics and used blackboards to plot out how attacks could be managed. As a mechanic, he also stressed the importance maintenance and reliability of the aircraft as paramount. Later, his rules included punctuality, loyalty, thrift, and a workaholic-like schedule (he would work seven days a week).

When the Armistice was declared in November 1918, Rickenbacker flew over No Man's Land alone and witnessed the lines of American and German troops meeting in celebration. When he was discharged, he was promoted to major, although he felt he hadn't earned that promotion and so used captain (he became known as 'Captain Eddie') for the rest of his career. He wrote a book, *Fighting the Flying Circus*, in 1919 but returned to the motor industry and founded the Rickenbacker Motor Company in 1922. Though soon burdened with massive debts, he refused to declare bankruptcy.

With backing he bought and became the president of the Indianapolis Motor Speedway in 1927 and took up a position with Cadillac and LaSalle for General Motors. He began writing a comic strip in 1933, *Ace Drummond*, which was syndicated in 135 newspapers nationwide. The stories were inspired by his WWI experiences. The illustrator for the comic was Clayton Knight, a fellow WWI aviator (although a New Yorker, he had flown

for the British Royal Flying Corps). The series was turned into a film serial in 1936.

All the while, Rickenbacker promoted the potential of aviation and encouraged several cities to develop airports. His most long-lasting venture was the establishment of Eastern Air Lines with help through his contacts at General Motors in 1934. He had already seen the potential of air mail and passenger transport in the 1920s and, with associates, he bought the company from General Motors in 1938, becoming president and general manager. In this capacity, Rickenbacker led many innovations in commercial aviation. He established connections with the Douglas Aircraft Company, although he later resisted the adoption of commercial jet aircraft – why replace perfectly good turboprop airliners with expensive jets, he asked. He also survived several air crashes (he did not use the word 'safe' of flying but preferred 'reliable'), such as in Atlanta in February 1941 when he was gravely wounded, taking more than a year to recover from his injuries.

Rickenbacker supported the USA joining World War II before the Japanese attack on Pearl Harbor in December 1941 and, when America joined the conflict, he toured training facilities in the USA and England as a non-military observer. He also directed Eastern Air Lines to fly American troops as well as munitions and other supplies across the Atlantic. (This was a requirement, but Rickenbacker encouraged the company to fulfill its duty to the best of its ability.) He

was involved in recommendations for military operations and was an advisor on bombing strategy to both the Royal Air Force and the United States Army Air Force.

In October 1942 he was sent by US Secretary of War, Henry L Stimson, to the Pacific theatre. His B-17D flew off course and needed to ditch close to Japanese-controlled islands. Adrift for 24 days, Rickenbacker assumed command of the survivors and they caught fish to sustain themselves – eventually all but one of the men was rescued. The ordeal led to reforms of survival equipment to include fishing gear and sun protection as well as navigation equipment. Rickenbacker was then sent to the USSR in 1943 on a fact-finding mission (including what the Russians were doing with Lend-Lease equipment). He had clashed with President Roosevelt prior to the war over cancellations of air mail contracts during the New Deal in 1934 and so all his 'official' missions came through Stimson rather than the president. At the conclusion of his trip, he did debrief with Winston Churchill but never met with President Roosevelt.

He resigned as president of Eastern Air Lines in 1959, finally retiring in 1963. He published his autobiography in 1967 and died in Switzerland in 1973 at the age of 82. His career is remembered for his achievements as America's Ace of Aces in WWI but his legacy extends well beyond that. In everything he did he brought persistence and determination to do the best he possibly could.

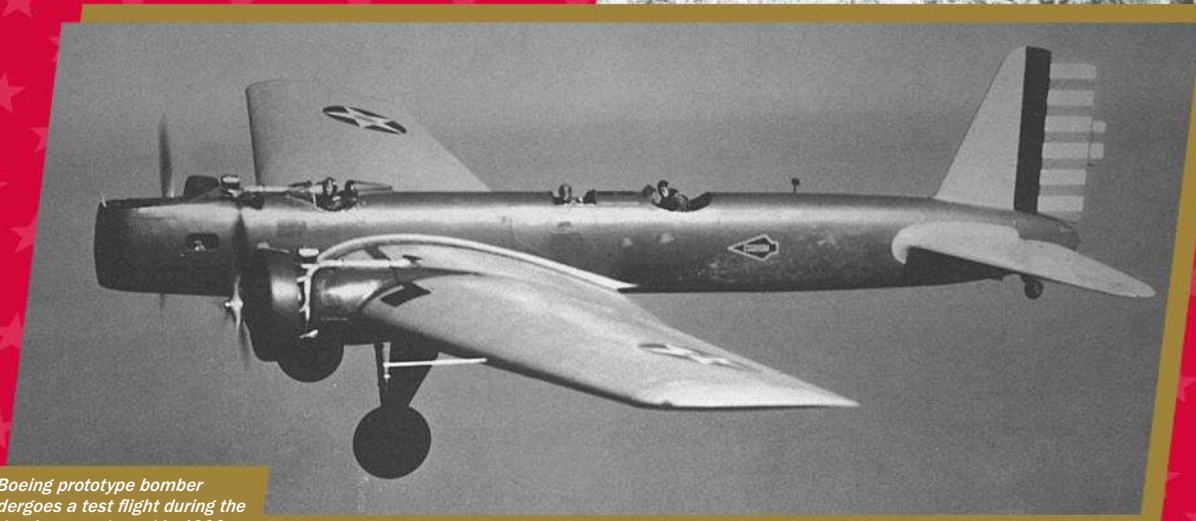
The US Army published this graphic illustration of aerial combat on the Western Front during World War I in 1918



American fighter pilot Lieutenant Frank Luke, killed in action on September 29, 1918, at age 21, stands beside his French-built SPAD XIII fighter



A Boeing prototype bomber undergoes a test flight during the evaluations conducted in 1932. The Army Air Corps was soon to experience significant growth





THE AIR SERVICE

The fledgling Aviation Section of the Signal Corps earned **COMBAT EXPERIENCE IN WORLD WAR I** and expanded into the US Army Air Corps by the 1940s

★ WORDS: MICHAEL E HASKEW ★



As war clouds gathered in Europe, US Army aviators, both in command and active flying roles, observed the proliferation of aircraft with great

interest. In the event, World War I became a proving ground for the strategy, tactics, men and machines of aerial warfare.

Reports of observation craft, pilot and observer flying above opposing trench lines to take photographs of enemy positions, were followed by those of swirling dogfights in the skies over the embattled countryside. Aces, those who scored five aerial victories or more, were lionised in their native countries, and the aura of the knights of the air became real.

While the Great War was prosecuted in Europe, the Aviation Section of the US Army Signal Corps was not idle. After missions were flown by the 1st Aero Squadron during tensions with Mexico in 1913, the aviators

flew in support of ground troops during the 1916 punitive expedition against Mexican outlaw Pancho Villa. When the United States entered World War I in April 1917, the first US air combat force was deployed to airfields on the continent of Europe. Although American pilots had flown as volunteers with Allied air forces, dedicated US aviators took to the skies flying fighter aircraft of British and French manufacture.

Captain Eddie Rickenbacker became the leading American ace of World War I with 26 aerial victories, while Lieutenant Frank Luke earned the nickname of the 'Arizona Balloon Buster' for his exploits in downing German observation balloons. The Aviation Section of the Signal Corps remained the authority under which US pilots flew for the duration of the conflict and was succeeded briefly by the Division of Military Aeronautics, then the Air Service, US Army and the US Army Air Corps, which was established in 1926 and existed until June 1941, the eve of American entry into World War II.

Between the world wars, budgetary restrictions inhibited growth to an extent. However, technological advances in aircraft design, engine power, armament and other critical aspects of military aviation continued. Formal training and operations facilities were authorised and constructed during the period. From the end of World War I in 1918 to the summer of 1941, the number of Army aviation personnel expanded from just short of 79,000 to more than 152,000 with an estimated 6,777 operational aircraft.

The pace of interwar expansion quickened with the expectation of another European war and eventual US involvement. During the late 1930s and early 1940s, the American military commitment to aviation was bolstered by the encouragement of President Franklin D Roosevelt, who called for the production of 50,000 military aircraft per year from 1940 onwards. Simultaneously, as World War II broke out in 1939, the US Congress was compelled to loosen its purse strings to fund the effort.



General Henry 'Hap' Arnold served as chief of US Army Air Forces from 1942 to 1946



Henry 'Hap' Arnold

AVIATION CHIEF

One of America's first military aviators, Henry 'Hap' Arnold was **AN ACCLAIMED PILOT** and led US air forces **DURING WORLD WAR II**

YEARS ACTIVE: 1907-1946 CONFLICTS: WWI, WWII
RANK: GENERAL OF THE ARMY, GENERAL OF THE AIR FORCE



he atmosphere in the courtroom was intense. General William 'Billy' Mitchell was the subject of a court martial for insubordination. Mitchell, the assistant chief of the

US Air Service, was outspoken in his advocacy of an air arm separate from the direct control of the US Army. He also forcefully advocated the development of the aircraft as a weapon of war, particularly in strategic and tactical bombing. Although he had many critics within the military establishment, Mitchell had also cultivated the support of some officers.

Among these supporters was Major Henry Harley Arnold. Warned that testifying on behalf of Mitchell might end his career, Arnold was willing to take the chance. Although his views were proven correct soon enough, Mitchell was convicted in December 1925. Then, indeed, Arnold felt the repercussions. He was offered a choice of resignation or a court martial of his own. When he chose the latter, Major General Mason Patrick rethought the implications of another high-profile military court proceeding. Instead, Arnold was assigned to Fort Riley, Kansas, to command the 16th Observation Squadron, far from where decisions regarding the future of air power were being made. Arnold was reprimanded for violating Army regulations and saddled with a fitness report that stung: "In an emergency he is liable to lose his head."

Rather than leaving the military, Arnold stayed on, serving in exile. Remarkably, he emerged as a respected and visionary leader of air forces during a critical period. By the time his career ended, 'Hap' Arnold had presided over an unprecedented development of American air power during World War II. In the twilight of his life he was promoted to five-star General of the Army and subsequently General of the Air Force, the only officer ever to hold the rank in two service branches.

Arnold was already a notable personage prior to his military career taking off. Born in Gladwyne, Pennsylvania, on 25 June 1886, to prosperous physician Herbert Arnold and Anna Louise 'Gangy' Arnold, he completed public schooling and considered entering Bucknell University. However, when his older brother disappointed their father by refusing to take the entrance examination for the US Military Academy at West Point, New York, Henry stepped up and did. His performance at the academy was mediocre, and he graduated in 1907, commissioned a second lieutenant.

Assigned to the 29th Regiment, he disliked the infantry life and petitioned for a transfer to the Aviation Section of the Army Signal Corps after his first exposure to flight while serving in the Philippines. On 21 April 1911, he received orders to Dayton, Ohio, for flight instruction. He spent two months in pilot training under Orville and Wilbur Wright, famed for their flight at Kitty Hawk, North Carolina, in 1903. With

that, Arnold became an American aviation pioneer, receiving pilot certificate no. 29 from the Fédération Aéronautique Internationale and Military Aviator Certificate No. 2.

While Arnold and colleague 2nd Lieutenant Thomas Milling were detailed to train new pilots at the Aeronautical Division, Signal Corps, in College Park, Maryland, Arnold established a new altitude record of 990 metres (3,260 feet),



Young pilot Henry H. Arnold sits at the controls of an aircraft. Arnold was a pioneer aviator in the US military



Fear of Flying

Shaken by numerous aerial mishaps, Henry 'Hap' Arnold once grounded himself and took a leave of absence

Although it may seem strange, General Henry 'Hap' Arnold, who led the US Army Air Forces during World War II, once developed a pronounced fear of flying. As an intrepid aviator, Arnold became a pilot while aviation was in its infancy. At first, he was fearless, setting altitude records and teaching others the skills necessarily to become pilots. However, a fellow aviator, Al Welsh, died in a crash in June 1911, and doubts began to prey on Arnold's psyche.

The developing concern was compounded by his own close calls. In August 1912, while piloting a Burgess Model H seaplane, Arnold was forced to put the plane down in Massachusetts Bay while high winds caused it to pitch violently. As he tried to take off again, the wind howled, a wing tip caught the water, and the plane crashed off the coast near Plymouth. Arnold was shaken and suffered a deep cut on his chin.

Meanwhile, West Point classmate Lewis Rockwell was killed in a crash in September 1912. In October of the same year, Arnold was flying with observer Lieutenant Alfred Sands, during an artillery spotting exercise. As he tried to land, the plane's engine stalled. The ensuing spin nearly cost the men their lives.

The stress had taken its toll. After grounding himself and taking a leave of absence, for which there were no administrative repercussions, Arnold found the fortitude to overcome his fear with short flying stints, 15 to 20 minutes, until he regained confidence and made his first solo flight in four years in November 1916.

Above: As a young man, Henry Arnold was fascinated with flight; later, as an officer, he overcame a fear of flying

"WARNED THAT TESTIFYING ON BEHALF OF MITCHELL MIGHT END HIS CAREER, ARNOLD WAS WILLING TO TAKE THE CHANCE"

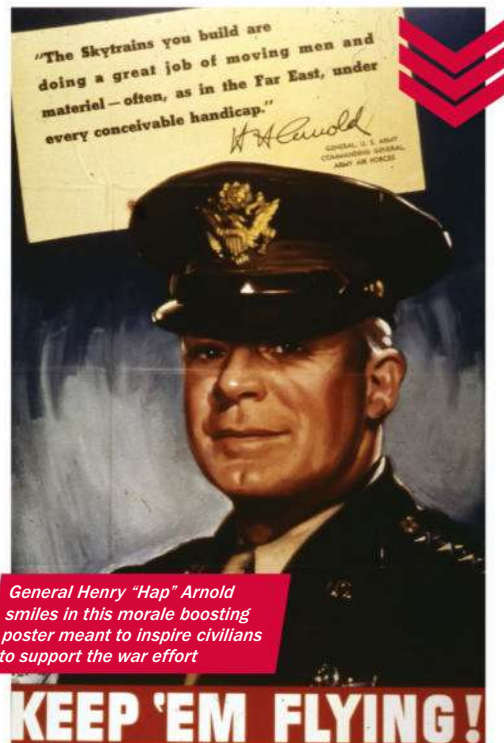
and then broke his own record three times. He became the first pilot to carry US mail, first to fly a plane over the US Capitol Building, and first to carry a US Congressman as a passenger. He went on to receive the MacKay Trophy twice, in 1911 and again in 1934, for the most outstanding military flight of the year. As a young pilot, he also featured in two silent films, performing flying sequences. Arnold survived a couple of plane crashes, while other accidents had claimed several lives during this period. He took a leave of absence from the armed forces in the autumn of 1912 and returned to duty that December.

During his sabbatical Arnold courted Eleanor 'Bee' Pool, and the two married in September 1913. They eventually had four children. The youngest, a son born in 1921, died two years later. Devastated by the loss, the couple grieved profoundly for a year.

During this time, Arnold worked in the Aeronautical Division of the Office of the Chief Signal Officer in Washington, DC. He returned to the air in the autumn of 1916, and the following spring was ordered to the Panama Canal Zone to find a suitable location for an airfield while putting together the 7th Aero Squadron, his first command. He later occupied several staff positions in aeronautical administration. As the US entered World War I, he hoped for an overseas assignment. When it finally came, the war was nearing its end, and in late October 1918 while aboard a ship he contracted influenza. He recuperated in a hospital in England and reached the Western Front on 11 November, the day the war ended.

Although the dust-up over Billy Mitchell temporarily jeopardised his future, Arnold's stance solidified his character and steadfastness. He worked to rehabilitate his career and succeeded with the help of other officers, particularly Patrick's successor as chief of the Army Air Corps, Major General James E Fechet. He wrote journal articles relating to air power that were well received, and fitness reports praised his service. In the summer of 1928, Fechet recommended to Army Chief of Staff General Charles Summerall that Arnold be sent to the Command and General Staff School at Fort Leavenworth. He graduated in 1929, his career rejuvenated.

Arnold took command of March Field, California, in November 1931, and three years later was named to lead three zones of the Army Air Corps Mail Operation. During this time he led a flight of ten Martin B-10B bombers on a long round-trip flight from Bolling Field in Washington, DC, to Fairbanks, Alaska, and earned his second MacKay Trophy. By February 1935, he had been promoted two grades, from lieutenant colonel to brigadier general and taken command of the 1st Wing of General Headquarters Air Force at March Field.



General Henry "Hap" Arnold smiles in this morale boosting poster meant to inspire civilians to support the war effort



General Henry 'Hap' Arnold enjoys a conversation in Washington, DC, with British Field Marshal Sir John Dill

At the same time, Arnold gained a reputation as a bomber advocate. He championed the development of the Boeing B-17 Flying Fortress and the Consolidated B-24 Liberator, four-engine, heavy strategic bombers that formed the backbone of the American air forces that pounded Nazi-occupied Europe during World War II and served with distinction in the Pacific Theater along with the later-

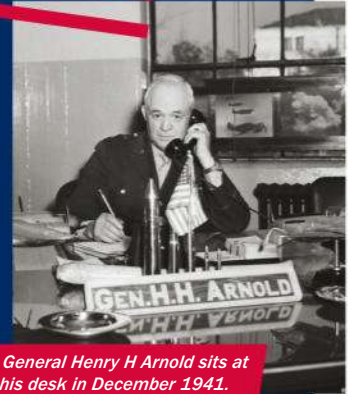
What's in a Name?

Known to history as 'Hap', General Henry H Arnold embraced the nickname later in his military career

General Henry H Arnold's famous nickname, 'Hap', was said to be short for 'Happy'. Some historians believe that it came into common usage during his brief stint of working in silent films, while others suggest his wife, Bee, was responsible for the adorable nickname.

Earlier in his lifetime, though, General Arnold was known by several other names. When he was just a young boy, several family members called him 'Sunny'. As a cadet at the US Military Academy, he was alternately known as 'Benny' or 'Pewt'. As his career developed, he attained high rank and responsibility in the US Army Air Forces. From this point onwards, he was often referred to simply as 'The Chief'.

However, it was most likely a family tragedy that brought the nickname 'Hap' into usage to refer to Arnold. Arnold's mother and father lost their wealth during the bank collapse of 1929 and the ensuing Great Depression. Possibly due to the difficult situation, his mother, nicknamed 'Gangy', died suddenly of a heart attack on 18 January 1931. Arnold was devastated by the loss of his mother, and she had always called him 'Sunny'. Bee, Arnold's wife, felt that continuing the use of that name would bring pangs of sorrow, and she began calling her husband 'Hap'. That name stuck, and from the spring of 1931 to the end of his life, the general signed personal correspondence with his most familiar nickname.



General Henry H Arnold sits at his desk in December 1941. At the height of his career, he was known as 'Hap'

developed Boeing B-29 Superfortress. By early 1936, he was a fixture in Washington, DC, and held the position of assistant to the chief of the Air Corps. On 29 September 1938, he was promoted to major general and named commander of the Air Corps, a triumph when considering his near dismissal a decade earlier.

In the summer of 1941, Arnold's title was revised to chief of the Army Air Forces, and as the storm of World War II broke in December with the Japanese attack on Pearl Harbor he was promoted to three-star lieutenant

general. Amid a major restructuring of the War Department under Chief of Staff General George C. Marshall, Arnold was named chief of the Army Air Forces. During the war years, he was responsible for all Army Air Forces operations, and the forces under his command grew exponentially from 22,000 personnel and 3,900 planes to 2.5 million in uniform and 75,000 aircraft.

General Arnold made a number of key appointments during the war, including General Carl Spaatz to lead the Eighth Air Force in

Europe and General Ira Eaker to command the bomber force, while also placing General Jimmy Doolittle, hero of a surprise raid on the Japanese capital of Tokyo, in key roles. Arnold demonstrated a rugged constitution and a willingness to relieve or reassign commanders whose performance was inadequate. He supported the costly but effective Allied strategic bombing campaign against Nazi Germany and placed General Curtis LeMay in command of the Twentieth Air Force in the Pacific, where LeMay unleashed a furious bombing campaign that laid waste to Japanese cities, helping to bring the Empire to its knees.

However, health problems plagued Arnold during World War II, including stomach ulcers that were blamed on stress and overwork, as well as four heart attacks between 1943 and 1945. Nevertheless, he made a 35,000-mile tour of installations in North Africa, the Middle East, India, and China, attended pivotal high-level conferences where strategic decisions were made, and was promoted to four-star general. His health deteriorated further in early 1946, when he developed a heart arrhythmia that caused him to suspend a trip to South America and compelled him to retire after nearly 40 years of service. He was promoted to five-star General of the Army rank in March, and a few months later his rank was changed to General of the Air Force, more accurately reflecting his career contribution. A giant of US military aviation, he lived to see the creation of a separate air service, the United States Air Force, in 1947.

Residing at his ranch near Sonoma, California, Arnold spent the majority of his last years writing, an avocation he had pursued all his life. While writing his memoirs, *Global Mission*, Arnold suffered his fifth heart attack in January 1948, which led him to spend three months in the hospital. He died at his home on 15 January 1950, age 63, and was buried at Arlington National Cemetery after sacrificing his health to achieve final victory in World War II.

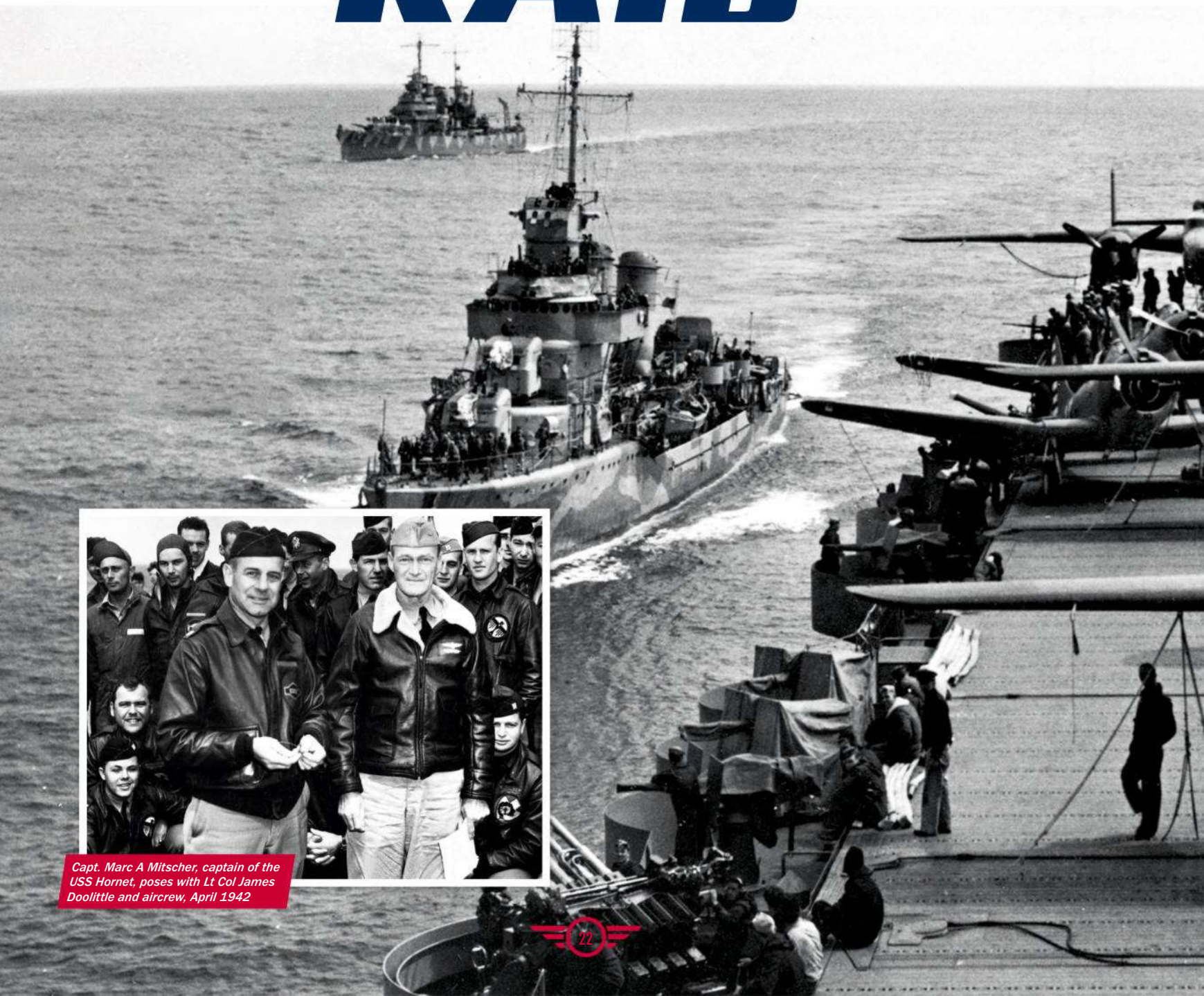
"HE WROTE JOURNAL ARTICLES RELATING TO AIR POWER THAT WERE WELL RECEIVED, AND FITNESS REPORTS PRAISED HIS SERVICE"



General Henry 'Hap' Arnold is seated at left during a conference of military leaders in 1943



THE DOOLITTLE RAID



*Capt. Marc A Mitscher, captain of the
USS Hornet, poses with Lt Col James
Doolittle and aircrew, April 1942*

On 18 April 1942, American bombers under the command of Lieutenant Colonel Jimmy Doolittle took off from the USS Hornet. **THEIR TARGET: TOKYO. THEIR MISSION: AVENGE PEARL HARBOR**

★ WORDS: MICHAEL E HASKEW ★



The Doolittle Raid was an audacious bombing attack against Tokyo on 18 April 1942, as American carrier-based aircraft struck the Japanese capital city. The raid was conducted by 16 North American B-25 Mitchell medium bombers of the US Army Air Forces (USAAF), flying from the deck of the aircraft carrier USS Hornet. This audacious mission was conceived, planned and executed within five months of the 7 December 1941 attack on Pearl Harbor. The bombing of US military installations had plunged the previously neutral nation into World War II.

The Doolittle Raid was undertaken in response to the string of Japanese victories during the early months of World War II in the Pacific. Following Pearl Harbor, the Japanese had seized Wake Island, Guam and the Dutch East Indies. Japanese forces were surging across the Philippines and advancing on all

fronts. The Doolittle Raid, though risky, was intended to bolster American morale and to strike a surprising blow against the Japanese, who considered their island nation unassailable by enemy forces.

President Franklin D Roosevelt expressed his personal interest in bombing Japan early in the Pacific War; however, the distance involved in crossing the expanse of the Pacific Ocean and the risk to precious US military assets made the prospects for such an attack seem remote. Nevertheless, Captain Francis S Low, commander-in-chief of the US Navy, proposed that USAAF bombers, which possessed greater range than naval aircraft, might be launched from the deck of an American aircraft carrier sailing within striking distance of the Japanese home islands.

PLANNING THE RAID

Although such a high-risk mission was fraught with danger, a joint Army-Navy task group was

B-25 bombers on the rear deck of the USS Hornet as it steams towards Japan, with two escort vessels following close in the background



detailed to work out a plan. Volunteer pilots and crewmen would be recruited to fly USAAF bombers from an aircraft carrier and bomb the Japanese capital city of Tokyo along with the nearby industrial centres of Nagoya, Osaka, Yokohama, Yokosuka and Kobe. The aircraft could carry only enough fuel to reach the targets from an optimal range of about 640km off the Japanese coast. The raiders therefore would complete their bombing runs against industrial targets in the cities and then fly on to land at friendly airfields in China. There would be no return flight to or recovery aboard the aircraft carrier.

Along with the B-25 Mitchell medium bombers, usually a land-based aircraft, 24 crews, each of five men, were chosen to train and potentially execute the raid. They were detailed to Eglin Air Base, Florida, for intensive training during March 1942. Navy pilots demonstrated carrier takeoff and landing procedures, and the Army aircrews practised on a stretch of runway painted to simulate a carrier flight deck, only 150m long. The B-25s were stripped of most of their armament in order to carry modest bomb loads, including three 500lb general purpose bombs and a single incendiary bomb cluster, along with as many containers of reserve aviation fuel as possible.

INTREPID JIMMY DOOLITTLE

For it to have any chance of success, the raid needed to be led by an experienced pilot with

nerve of steel and outstanding command presence. Lieutenant Colonel Jimmy Doolittle was chosen for the task. He was a 45-year-old former bantamweight boxer, oil company executive, mining engineer, veteran of World War I and a pioneer aviator. He had served as a flying instructor during the Great War and performed as a stunt pilot during the 1920s. Doolittle was also an air racer, competing for the prestigious Schneider Trophy against international aviators, and winning the Bendix Trophy in 1931. In the same year he captured the Thompson Trophy at a competition in Cleveland, Ohio, setting a world speed record of 406.65kph in an 800-horsepower Gee Bee Super Sportster.

Doolittle had remained in the Army Air Corps reserves and was called to active duty in July 1940 with the rank of major. Prior to the planning for the bombing raid on Tokyo, he toured British Royal Air Force installations in Europe and Asia. He was promoted to lieutenant colonel in January 1942 and soon tapped to lead the risky raid.

"It had three real purposes," Doolittle told an interviewer later. "One purpose was to give the folks at home the first good news that we'd had in World War II. It caused the Japanese to question their warlords, and from a tactical point of view it caused the retention of aircraft in Japan for the defence of the home islands when we had no intention of hitting them again, seriously, in the near future. Those airplanes

would have been much more effective in the South Pacific where the war was going on."

THE MISSION MOVES FORWARD

After rigorous training, 16 aircrews were chosen for the historic mission and on 1 April 1942 they boarded the aircraft carrier USS Hornet at the Alameda Naval Air Station in San Francisco Bay. The B-25s were lashed to the carrier deck, as they were too large for stowage on the hangar deck below, and two days later Hornet put to sea, sailing beneath the Golden Gate Bridge and into the Pacific. It was joined by an escort of two cruisers, four destroyers and a fleet oiler.

Only after boarding Hornet were the aviators informed of their target. Doolittle addressed them: "For the benefit of those who have been guessing, we are going to bomb Japan. The Navy will get us as close as possible, and launch us off the deck." He asked if any of the men wanted to opt out of the hazardous mission, and none did.

On 8 April, a second US Navy task force steamed out of Pearl Harbor, headed for a Pacific rendezvous with Hornet and her consorts. The aircraft carrier USS Enterprise, two cruisers, four destroyers and another oiler met the Hornet group in the open sea on 13 April, and the combined Task Force 16 headed for enemy waters.

The element of surprise had always been a key component in the American plan, but the fortunes of war nearly created a catastrophe. At 7:38am on 18 April, Task Force 16 was approximately 1,000km off the Japanese coast. In the morning mist, a 70-ton Japanese



The crew of No. 2 Doolittle bomber, which crash-landed in China after the raid, photographed on the USS Hornet shortly before the mission embarked on its daring bombing run



A B-25 bomber prepares for take-off from the aircraft carrier USS Hornet as part of the Doolittle Raid on Japan, April 1942



American B-29 bombers fly close to Mount Fuji, in 1945. US bombing raids grew more regular once air superiority had been achieved over Japan close to the end of WWII

"THE ELEMENT OF SURPRISE
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*Lieutenant Colonel Jimmy Doolittle
was selected to lead the daring raid
due to his vast experience as a pilot
and outstanding leadership skills*





No. 2 Doolittle bomber crew with Tung Sheng-Liu (in the light blazer), a Chinese national who helped the stranded airmen escape after their crash-landing

patrol boat, No. 23 Nitto Maru, was sighted on the horizon. No doubt lookouts aboard the vessel had seen the large American task force and were busy alerting higher command in Japan. Immediately, the light cruiser USS Nashville went to battle stations and engaged the enemy, sinking the patrol boat with gunfire and then pulling 11 survivors out of the water.

The Americans were on the horns of a dilemma. They had been discovered but were unsure as to whether the warning from Nitto Maru had reached Tokyo and even then if the Japanese would take further action. The options appeared grim – abort the mission and steam away rapidly or launch the B-25s immediately, from a distance 320km further from Japan and ten hours earlier than planned. The carriers were vulnerable and critical to the American war effort – virtually irreplaceable. To make matters worse, weather conditions were far from ideal. Vice Admiral William F ‘Bull’ Halsey and Doolittle chose the latter course of action.

BOMBERS AWAY!

At 8:20am on 18 April 1942, Doolittle revved the twin engines of the first B-25 bomber to launch from Hornet. He gained speed as the plane roared down the pitching flight deck. The B-25 dipped precipitously toward the wavetops and then clawed its way into the air, ocean spray whipping in all directions. One by one, the other B-25s followed. They formed up amid low clouds and then headed for Japan at 360kph, their throttles leaned to conserve precious fuel.

The American planes flew low and hugged the Japanese coastline after making landfall. Flying over Honshu, the largest of the home islands, they climbed to 1,200 feet in clear skies as they neared their target cities. The airmen were under specific orders to avoid dropping their payloads on the Imperial Palace, the residence of Emperor Hirohito, or any civilian targets such as schools, markets, hospitals or residential areas. This was a tactical strike.

As the American bombers swept over the suburbs of Tokyo, surprise was total. Children playing in schoolyards waved at the low-flying planes and civilians in the crowded, bustling streets took virtually no notice of the aircraft, thinking they were friendly. Air raid drills were common, as were military exercises, so they went about their business.

At 12:15pm, Doolittle released his bombs above the Japanese capital city. The second B-25, piloted by Lieutenant Travis Hooper, made its run as well. Others followed suit, and the bombers assigned to hit the remaining cities completed their missions. Air defence was nearly non-existent. A few bursts of

anti-aircraft fire blossomed, and fighters were scrambled late in the game, but to no avail. Although little real damage was done, one 500lb bomb struck the Imperial Japanese Navy aircraft carrier Ryuho, drydocked for repairs at Yokosuka, and smoke roiled skyward from factories, oil storage tanks and other facilities. The Japanese high command was stunned, and the repercussions of the raid were destined to alter the course of World War II in the Pacific.

THE PERILOUS PASSAGE

The American bombers themselves had been scattered during the raid and tried to regroup as best they could en route to the Chinese airfields. The crewmen particularly hoped to reach the landing strip at Chiuchow in Guangdong Province, about 2,500km from Tokyo, and avoid Japanese troops on the Asian mainland. Bad weather forced the B-25 pilots to fly low at first, some descending to 600 feet before opting to climb into the murky clouds and continue on instruments.

As the Americans reached the Chinese mainland, their fuel tanks were nearly depleted after 13 hours in the air, and Chiuchow could not be raised on their radios. Crucial minutes slipped away, and several pilots were compelled to ditch in coastal waters or crash land. One plane landed at an airfield in Vladivostok, in the Soviet Union, and its crew was interned for the duration of the war.

“When you do a bombing mission, you like to bring your airplanes home,” remembered Doolittle, who parachuted to earth in a soggy rice paddy. “I had scattered mine all over different parts of China.” Doolittle told a member of his crew: “You know what’s



going to happen? I'll be put in Leavenworth Prison for having missed the mission."

Only one of the 80 airmen involved was killed during the surprise raid, while eight men were captured by the Japanese. After a show trial in China, these prisoners were transported to Tokyo, where three were beheaded and one died in prison. The Japanese had conducted a three-month search for American personnel, brutalising the Chinese populace and killing thousands while torching villages.

The remaining Doolittle Raid survivors found their way out of China, aided by friendly farmers and townspeople along the way. They travelled in secrecy and several narrowly avoided capture while attempting to reach Chungking, the wartime Chinese capital. Doolittle went on to hold high command in the USAAF during the rest of World War II, including command of the Eighth Air Force in England.

News of the Doolittle Raid was not immediately made public. However, President Roosevelt awarded the Distinguished Flying Cross to the men involved. When the President finally acknowledged the raid publicly, he was asked where the attacking bombers had come from. Roosevelt grinned and replied, "Shangri-La!" in reference to the mythical Asian realm in author James Hilton's best-selling 1933 novel *Lost Horizon*.

THE JAPANESE RESPONSE

For the Japanese military and political hierarchy there was obviously no humour in the Doolittle Raid. In fact, it had become abundantly clear that the island nation was not impregnable and might be attacked again from the air. Therefore the decision was made to extend the Japanese



defensive perimeter further across the expanse of the Pacific.

Admiral Isoroku Yamamoto, commander of the Imperial Japanese Navy's Combined Fleet, hastily devised plans to seize Port Moresby, at the southeastern tip of the island of New Guinea, and threaten Australia. Then, he intended to rapidly move against the American base at Midway Atoll, 1,800km from Hawaii. In both instances, the Japanese were thwarted, first in the Battle of the Coral Sea in May 1942,

and then in the epic Battle of Midway the following month. Japanese losses at Midway were shattering, and the defeat of the Imperial forces is considered the turning point of World War II in the Pacific.

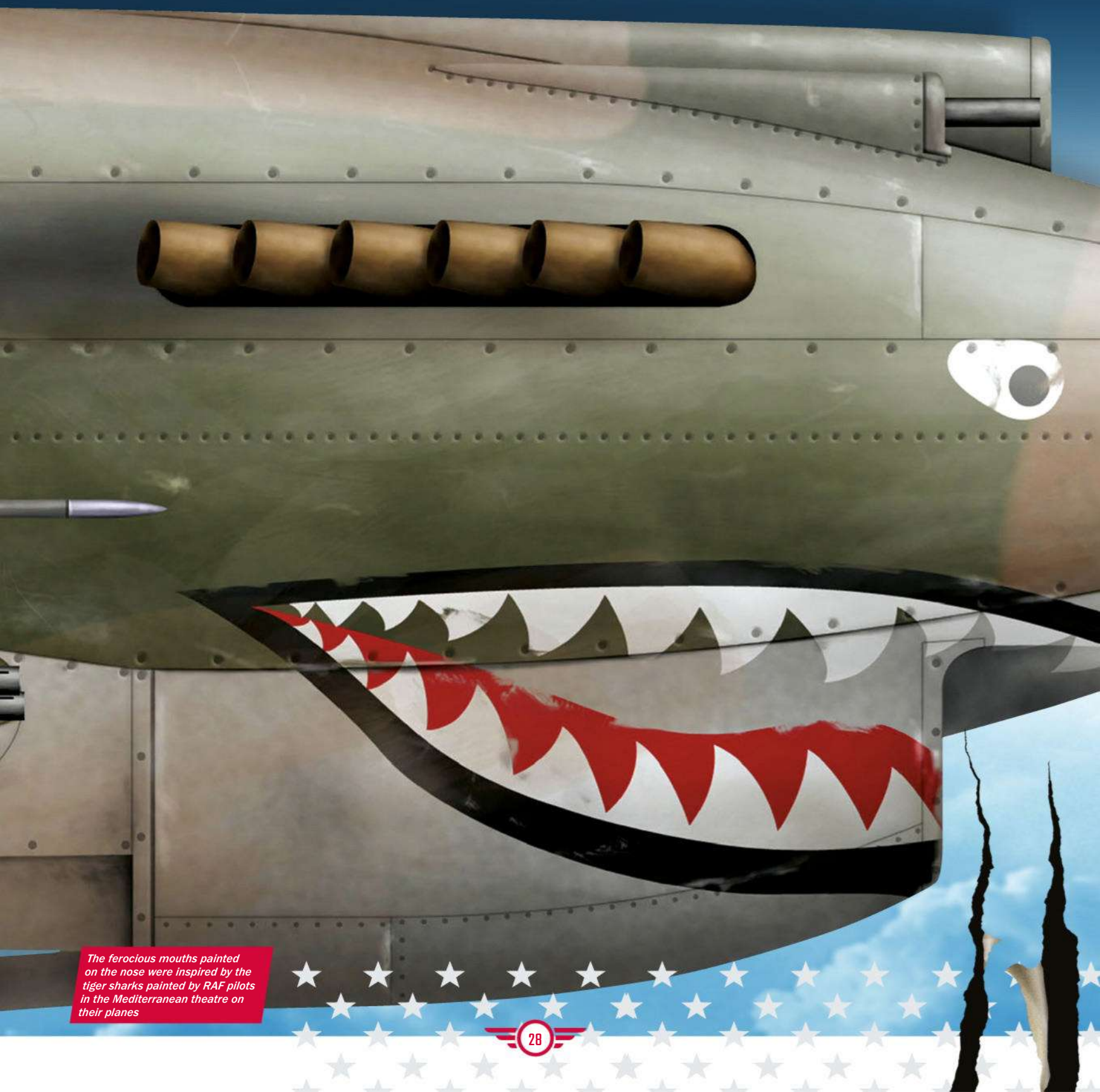
The strategic consequences of the Doolittle Raid were far greater than the fairly minor damage inflicted by the handful of American bombers: Japanese ambitions in the Pacific were suspended for a defensive posture that ultimately led to their defeat.

The crews of the Doolittle Raid receive their Distinguished Flying Cross medals at Bolling Air Force Base, Washington DC, 29 June 1942





THE FLYING



The ferocious mouths painted on the nose were inspired by the tiger sharks painted by RAF pilots in the Mediterranean theatre on their planes



TIGERS

How the **OUTNUMBERED FIGHTER ACES** of the American Volunteer Group **DEFIED IMPERIAL JAPAN** in war-torn China



They expected a routine mission. Japanese planes owned the skies over China, but the pilots and crewmen who boarded the ten Mitsubishi Ki-21 twin-engine bombers on the morning of 20 December 1941, intended to cover the 300 air miles from their base at Hanoi to the Chinese city of Kunming, drop their incendiaries and 500-pound bombs, and return unscathed. There was no need for a fighter escort.

For a decade the armed forces of Imperial Japan had been at war on the Asian continent. They staged the Mukden Incident in 1931 as a pretext to seizing the northern province of Manchuria from China, and another so-called 'incident' in 1937 at the Marco Polo Bridge, near the city of Peking (Beijing), to escalate the simmering conflict into what became known as the Second Sino-Japanese War. The Chinese resisted bravely on land and in the air. However, the resources of the Nationalist government of Generalissimo Chiang Kai-shek were few, and often ineffective in the face of the overwhelming Japanese onslaught.

Nowhere was the military contest more unequal than in the air. The Japanese flew modern planes, their pilots were well trained, and with each mission their confidence grew. Japanese fighter pilots regularly shredded the defending planes of the Republic of China Air Force, most of which were obsolete American-designed Curtiss BF2C Goshawk biplanes along with a few British, Italian, and Soviet types. Chinese pilots were often the sons of wealthy, influential families who graduated from flight training with wings pinned to their chests regardless of proficiency.

These ill-prepared fliers were often killed, their valuable aircraft destroyed in takeoff and landing incidents, while those who managed to engage in aerial combat fell to Japanese guns at an alarming rate. By 1941, although the Republic of China Air Force officially listed a complement of 500 planes, which was probably overstated, barely 90 aircraft were considered battleworthy at any given time.

However, during that morning mission to Kunming, the Japanese were made keenly aware that the situation in the skies above China, and neighbouring Burma, had been dramatically altered. As they approached their target, the Japanese pilots spotted something unusual. Four tiny dots were rapidly bearing down on them, and it was soon apparent that these were hostile fighter planes. The Japanese



Chinese soldiers and armourers of 74th Fighter Squadron inspecting a Curtiss P-40 in Kunming, China, 1 February 1943

released their bombs 30 miles southeast of Kunming and turned for home at high speed.

These unexpected attackers were, in fact, Curtiss P-40 Tomahawk fighters led by Lieutenant John V 'Scarsdale Jack' Newkirk. Ten more P-40s joined the pursuit, and one by one the Japanese bombers were shot to pieces, exploding in midair or trailing thick, black smoke as they spiralled into the ground. A single bomber survived to report the details of the harrowing mission. The crewmen described their attackers as heavy, single-engine fighters with snarling shark's mouths painted on their engine cowlings. Their comrades had been the first victims of the flamboyant airmen of the American Volunteer Group (AVG), popularly known as the Flying Tigers.

The initial aerial combat mission of the Flying Tigers had been a resounding success, and newspaper reports flashed across the globe. This provided a much-needed morale boost for the American public, still stunned by the sudden attack on Pearl Harbor that had plunged the nation into World War II only two weeks earlier, and offering hope to the beleaguered Chinese.

For years, Chiang Kai-shek had realised that he needed help from the United States to stem the Japanese tide. However, a major obstacle to securing American aid was the simple fact the country was not a belligerent during the 1930s. An overt act to provide military support to China might, in fact, provoke the Japanese into declaring war on the United

States. Nevertheless, Chiang possessed two quite powerful assets in his quest for American assistance. His wife, Soong Mei-ling, also known as Madame Chiang, was a charming and shrewd political pragmatist, while the Nationalists also benefited from a powerful lobby in the United States led by her brother, TV Soong, who moved easily through the halls of power in Washington, DC.

Madame Chiang was charged with raising the combat prowess of the Republic of China Air Force, and she proved quite capable in the role. Without doubt, her most significant accomplishment was in persuading a grizzled American captain to come out of retirement in Louisiana, travel halfway around the world, and take on the monumental task of revitalising the flagging fortunes of the Chinese air arm.

Claire Lee Chennault was a veteran of the US Air Corps and a former stunt flier. To the detriment of his career, he had also been a tireless, vocal champion of developing fighter aircraft and tactics, during an era that was dominated by senior officers who promoted the deployment of heavy bombers bristling with guns. The prevailing sentiment among these officers was that the big bombers could defend themselves without the help of fighter escorts, pound enemy cities and military targets, and actually win a modern war by raining devastation from the skies.

Chennault never bought into that concept and argued forcefully against the prevailing fighter tactics that emerged during World War I. "There

was too much of an air of medieval jousting in the dogfights," he said boldly, "and not enough of the calculated massing of overwhelming force so necessary in the cold, cruel business of war." He believed that fighter pilots should work together in pairs and in larger numbers rather than as lone hunters, and in 1935 he put his theories on paper in the book *The Role of Defensive Pursuit*.

Within months of his book's publication, Chennault was serving as an instructor at Maxwell Field, Alabama. He was notified that the teaching of fighter tactics was to be terminated. Suffering from hearing loss sustained during hours of flying in open cockpits along with chronic bronchitis, Chennault retired with 20 years of service in 1937, still a junior officer at the age of 47.

Although few in Chennault's own country had paid any attention to his fighter doctrine, General Mao Pang-tso of the Republic of China Air Force attended one of his flying demonstrations and passed along his favourable impressions of the American pilot's skills. It was then that Madame Chiang charmed Chennault, who visited the country in the spring of 1937 during negotiations to procure his services. He later remarked, "She will always be a princess to me."

In his own way, Chennault learned to manipulate Madame Chiang, tendering his resignation to her when the Nationalist government moved too slowly regarding some issue or failed to provide support in a timely



A Chinese soldier stands guard over a P-40E Warhawk. The plane was flown by Major John Petach who accumulated 5.25 kills

CBI air rage

Flying Tiger pilots in their Curtiss P-40 Warhawk fighters fought superior numbers of Japanese planes above China and Burma

manner. Madame Chiang always refused to accept the commander's resignation, and she remained his foremost advocate during later contentious disagreements with General Joseph Stilwell, the American commander in the China-Burma-India Theater (CBI) during World War II. Through his association with Madame Chiang, and the exploits of the Flying Tiger pilots, he would soon command, Chennault became one of America's early heroes of the war, exerting tremendous influence on its conduct in the CBI.

Chennault took to his initial task with renewed vigour, enhancing the training of Chinese pilots and establishing an early warning network to alert his bases to incoming Japanese air raids. Among the formidable enemy aircraft his pilots faced was the Nakajima Ki-27 fighter, which was introduced in 1937, and later the Nakajima Ki-43 and the legendary Mitsubishi A6M Zero.

Chennault admonished his pilots to be wary of the nimble enemy planes and to avoid single combat. "Never get into a dogfight with the Zero," he told them. "When you spot the Zeroes, make one diving run with guns blazing, and then get the hell out of there!"

Chennault did his best, but Japanese air power was overwhelming, and large formations of enemy bombers hit Chinese cities at will while fighter planes strafed Chinese troops on the ground. As the situation worsened, Chiang Kai-shek turned to his brother-in-law. Soong persuaded President Franklin D Roosevelt to allow Chennault to quietly recruit American pilots and to eventually purchase 100 new Curtiss P-40 fighters for these 'volunteers'. The planes had been earmarked for the British through the Lend-Lease program but were considered outdated and rejected for service with the RAF.

Six months prior to Pearl Harbor, Chennault had successfully recruited 112 American pilots, who were allowed to resign from the US armed forces and join the Chinese with the promise that they could return to the American military if the US became a belligerent or when their contracts with the Chinese were completed. The lure of adventure and a fat paycheck weighed heavily in the decisions of these young men. The American Volunteer Group paid \$750 a month to a squadron leader, \$675 to a flight leader, and \$600 to a wingman. Ground crewmen were compensated handsomely from \$150 to \$300 a month depending on an individual's skill set. To sweeten the pot, the Generalissimo added a \$500 bounty for every confirmed shootdown of a Japanese plane.

In the interest of operational secrecy, the American pilots were provided with fake documents and information that presented them as individuals with occupations from engineers to tailors and Vaudeville performers. "I joined the AVG in July 1941," remembered Donald Whelpley, who became the group's lead meteorologist. "At that time my duty assignment was Navy meteorologist to Patrol Squadron 54, Naval Air Station, Norfolk, Virginia," he continued. "When the Navy finally

CURTISS P-40 WARHAWK

Fast in level flight and capable of out-diving the Japanese fighters that the pilots of the American Volunteer Group faced, the Curtiss P-40 fighter was well suited to the 'boom and zoom' tactics advocated by Flying Tiger boss Claire L Chennault.

YEARS IN SERVICE: 1939-1945
MAX SPEED: 580 KM/H (360 MPH)
ARMAMENT: SIX .50-Z (12.7MM) BROWNING M2 MACHINE GUNS



NAKAJIMA KI-27

Lightly armed and armoured, the Nakajima Ki-27 fighter, nicknamed 'Nate' by the Allies, was highly manoeuvrable and easily out-turned Allied opponents flying Curtiss P-40s in a dogfight. However, it was rapidly outclassed by other aircraft types early in World War II.

YEARS IN SERVICE: 1937-1945
MAX SPEED: 470 KM/H (292 MPH)
ARMAMENT: TWO 7.7MM TYPE 89 MACHINE GUNS



MITSUBISHI A6M ZERO

One of the legendary fighters of World War II, the Mitsubishi A6M Zero was highly manoeuvrable, heavily armed, and superior to early Allied types. ROC Air Force pilots faced the Zero, but debate continues as to whether Flying Tiger pilots did.

YEARS IN SERVICE: 1940-1945
MAX SPEED: 534 KM/H (332 MPH)
ARMAMENT: TWO 7.7MM TYPE 97 MACHINE GUNS; TWO 20MM TYPE 99-1 CANNON



realised that I was serious about resigning my commission to join Chennault in China, they released me for a one-year tour with the AVG. Little did any of us realise what we had gotten ourselves into."

The recruits sailed to China and maintained their cover. Some of them posed as employees of the Central Aircraft Manufacturing Company (CAMCO), which operated a facility in Burma that assembled planes for the Chinese. By the summer of 1941, Chennault was putting them through their paces at an airfield in Loiwing, China, near the border with Burma.

A remedial training school was established after it was discovered that some of the recruits had lied about their experience in 'pursuit planes' and had only flown bombers or transports. Chennault lectured the aviators regularly, often using a chalkboard to illustrate his points, and shook his head in despair when one of his precious P-40s was damaged in training. The young pilots embraced Chennault's teachings and began referring to the commander as 'Old Leatherface'.

The AVG's P-40s were shipped in crates from New York, but even before they were assembled and took flight, one of the planes met an unfortunate fate. The very first of the crates was being loaded into the hold of a freighter when the cable snapped, sending the entire load plummeting into the Hudson River below. The engine and all the cockpit controls were damaged beyond repair – and just like that, the AVG was down to 99 planes. If Chennault considered the accident a bad omen, he shrugged it off and kept that sentiment to himself. The remaining planes were all shipped to Burma, where they were assembled at the CAMCO factory outside the port city and capital of Rangoon. Test flights took place at a nearby airfield, and the P-40s were then delivered to the AVG.

Chennault organised his planes and pilots into three squadrons of equal size. The 1st Squadron, with fuselage numbers 1-33, was nicknamed the Adam and Eves. The 2nd Squadron, fuselage numbers 34-66, was dubbed the Panda Bears, while the 3rd Squadron, fuselage numbers 67-99, was called the Hell's Angels. For a time, the AVG pilots and their ground crew shared the Kyedaw airfield near Toungoo, Burma, with units of the RAF.

Some of the AVG pilots heard that RAF personnel of No 112 Squadron, flying P-40s based in North Africa, had painted the mouths of fearsome tiger sharks on their engine cowlings, probably copying the design from a unit of the German Luftwaffe they had encountered over the Mediterranean Sea. The artists among the Americans went to work replicating the razor-toothed jaws on the noses of their own aircraft, and soon the Chinese began referring to the mercenary pilots as 'Flying Tigers'. The nickname stuck, and a cartoonist from Walt Disney Studios complemented the gaping sharks' mouths with the image of a stylish Bengal tiger wearing wings and leaping through a 'V' for victory emblazoned on the fuselages of many P-40s.

Curtiss P-40

The warbirds of the AVG may be remembered for their iconic nose art, but it took more than graphic design to win the air war for Chinese freedom



MOUTH & EYE

The distinctive shark's mouth and menacing eye became world famous as emblems of the Flying Tigers. The pilots painted the nose cowls of their P-40s to strike fear in the hearts of enemy airmen.

ENGINE

The Allison V-1710 12-cylinder liquid-cooled engine produced 1,350 horsepower and a maximum speed of 378 miles per hour. The V-1710 was the only engine of its kind produced in the United States during World War II.

VISIBILITY

Visibility was adequate although restricted by the complex windscreen frame. Ground visibility was especially poor, which contributed to accidents along with the narrow landing gear.

FIRE EXTINGUISHER

A fire extinguisher was kept under the seat and a first aid kit was attached to the right-hand side of the cockpit. Both could mean the difference between life and death.

COCKPIT

The armoured cockpit absorbed punishment and contributed to pilot survivability. In contrast, Japanese aircraft were lightly armoured and quite susceptible to explosions in midair.

LANDING GEAR

The narrow landing gear track made the P-40 prone to accidents on the ground. Numerous fighters were lost in training accidents with novice Chinese and American pilots at the controls.

ARMAMENT

.50-calibre Browning M2 machine guns provided heavy firepower. Some variants of the P-40 also mounted .30-calibre machine guns; however, the heavier Browning M2 was more effective against enemy targets.

AIRFRAME

The steel airframe made the aircraft heavy and rugged. Such construction made the P-40 capable of absorbing tremendous amounts of enemy fire and bringing its pilot home safely. Ground crewmen patched damaged aircraft and got them back into the air as rapidly as possible.

Although they flew as a combat unit for only seven months, from December 1941 to July 1942, the Flying Tigers gained lasting fame in the skies of the CBI during World War II. Training mishaps, mechanical failures – particularly with the P-40's Allison engine – and combat damage continually reduced the number of operational aircraft, and Chennault never had more than 55 planes and 70 pilots at his disposal. Still, the Flying Tigers compiled a remarkable record, confidently debunking the myth of Japanese aerial invincibility in the process.

During those frenetic days, the AVG claimed 299 enemy planes – destroyed both in the air along with scores on the ground – shot up during dangerous strafing runs. Its top scoring aces accounted for more than 60 Japanese aircraft. They included Robert Neale with 13 victories, Ed Rector with 10.5, David Lee 'Tex' Hill with 10.25, and George Burgard, Robert Little, and Charles Older each with ten.

In turn, the Flying Tigers lost four pilots in the air to Japanese planes, six who were killed during strafing runs against ground targets, three who perished in training accidents, and three who died during enemy bombing raids. Three AVG pilots were shot down and taken prisoner. A dozen P-40s were lost in aerial combat, while another 61 were destroyed on the ground during enemy air raids, in training accidents, or deliberately when the airfield at Loiwing was hastily evacuated with the fall of Burma in May 1942.



A 'blood chit' given to the Flying Tigers by the Nationalist Chinese government. It would be used as identification so that downed airmen could get aid from any Chinese civilian they came across

Chennault initially deployed the Flying Tigers in two groups, defending both Rangoon and western China, where the Burma Road, the overland supply line that stretched 600 miles from Lashio in northern Burma to Kunming, snaked through mountains and valleys.

The first Flying Tiger missions were flown on 8 December 1941, the day after Pearl Harbor.

As word of their success became public, the pilots were lionised in the press. Following one notable air battle, a newspaper crowed, "Last week ten Japanese bombers came winging their carefree way up into Yunnan, heading directly for Kunming, the terminus of the Burma Road. 30 miles south of Kunming, the Flying Tigers swooped, let the Japanese have it." The paper continued, "Of the ten bombers, four plummeted to Earth in flames. The rest turned tail and fled. Tiger casualties: none."

Even the Japanese grudgingly acknowledged the toll the Flying Tigers were taking as the aggressive pilots employed Chennault's maxim, "Use your speed and diving power to make a pass, shoot, and break away! Never, never, in a P-40, try to outmanoeuvre and perform acrobatics with a Jap Zero. Such tactics, take it from me, are strictly non-habit forming."

Radio Tokyo issued a stern warning that AVG personnel rather enjoyed. "The American pilots in Chinese planes are unprincipled bandits," the propagandist blared. "Unless they cease their unorthodox tactics they will be treated as guerrillas." The broadcast was a veiled threat that if a Flying Tiger pilot was captured, he might well be executed.

Adding to the Flying Tiger mystique was the cavalier attitude of the pilots and their disdain for military protocol. Little attention was paid to rank or station, and there was simply no such thing as a regulation uniform. Footwear included cowboy boots with thick heels. The pilots also engaged in aerial antics, performing



Christmas combat

Perhaps the most dramatic engagement of the Flying Tigers' brief combat history took place on Christmas Day, 1941

On 25 December 1941, the Japanese launched their second heavy air raid against Rangoon, the Burmese capital, in 48 hours. At Mingaladon airfield, north of the city, Christmas Day was a muggy 46 degrees Celsius, smothering the pilots of the Flying Tigers' 3rd Squadron, the Hell's Angels. Suddenly, the air raid siren wailed. 13 Hell's Angels pilots sprinted to their Curtiss P-40 Tomahawk fighters, joined by 16 pilots of No 67 Squadron RAF flying their Brewster Buffalo fighters.

Just past noon, the characteristic V-formation of 71 enemy bombers and at least 30 fighters appeared. Charles Older, who had flamed two enemy bombers on 23 December,

roared upward in a near-vertical climb, opening fire at 200 yards and tearing an enemy plane apart with his six .50-calibre machine guns. Executing a flawless 'boom and zoom', he broke away in a power dive and made another pass. This time, a second bomber fell to his guns. When the Japanese turned toward home, Older pounced on an escorting Nakajima Ki-43 'Oscar' fighter and sent it spiralling earthward for his fifth kill. He had become an ace.

Flying Tiger Robert P 'Duke' Hedman was credited with taking down four Japanese bombers and a fighter, attaining the coveted status of ace

in a single day. George McMillan shot down three enemy planes, while Tommy Haywood and Ed Overend each claimed a pair to their tally. As Robert 'RT' Smith pulled away from his second kill against the bombers, he confronted an Oscar slicing toward him head-on, guns blazing. Smith held steady. His P-40 shuddered as bullets from its guns raked the enemy. In a flash, the Japanese plane passed below, billowing smoke before rolling over and plunging into the Gulf of Martaban. The Flying Tigers and their RAF allies claimed 32 aerial victories in the swirling Christmas Day battle, while on their side only two P-40s were shot down, along with four Buffaloes.

The Japanese expected the Ki-43 Oscar to perform well against Curtiss P-40s





General Henry 'Hap' Arnold inspects the Flying Tigers squadron with Claire Chennault



Maintenance on a Curtiss P-40 at Kunming, China, circa 1941

aerobatic feats and slow, low victory rolls to celebrate their kills when they returned from combat missions.

Alcohol flowed freely, and one story relates that a group of Flying Tigers persuaded the pilot of a C-47 transport plane to conduct a nocturnal 'air raid' on Hanoi. The Americans scrounged for any explosives they could find, including old ordnance of French and even Russian manufacture. Fortified with liquid courage, they packed the C-47's cargo hold with bombs. When they arrived above their target, they reportedly opened the side door, kicking and rolling the explosives into the night.

Before Chennault withdrew all AVG fighters from Burma in the spring of 1942, the Flying Tigers engaged in several large-scale aerial battles with the Japanese, and their RAF allies joined in as well. On 23 December 1941, a flight of 12 Hell's Angels P-40s along with Brewster Buffalo fighters of No 67 Squadron RAF engaged a formation of Japanese Ki-21 bombers headed for Rangoon. The Allied planes shot down five bombers and four escorting fighters, but a pair of P-40s was lost. Despite the better kill results, Chennault considered the mission a setback since he had few planes or pilots to spare.

On 25 February 1942, a force of 166 Japanese fighters and bombers attacked Rangoon. Nine Flying Tiger pilots gunned the engines of their P-40s and descended on the enemy like avenging angels. 24 Japanese aircraft were shot down in flames, while three P-40s were lost. A day later, 200 more Japanese aircraft appeared above the city, and six Flying Tiger P-40s mounted a spirited defence, roaring through the enemy formations to claim 18 planes destroyed.

19 Flying Tiger pilots were officially credited with five or more confirmed aerial victories during their combat tours with the AVG, achieving ace status. Tex Hill served as a flight leader and squadron commander with the Panda Bears and, in addition to his 10.25 kills

with the AVG, finished the war with 15.25. He scored his first aerial victories on 3 January 1942, during a strafing mission against the Japanese airfield at Tak, Thailand, and vividly recalled the encounter.

"I was really excited as we neared the target area. It was then that I noticed there were too many of us in formation," Hill remembered. "Somehow a Japanese Zero swooped in and got on the tail of the P-40 in front of me. I pulled the trigger, fired my machine guns, and shot the Zero down. Unknown to me there was another Zero up there with us, but I didn't see him in time. He put 33 bullet holes in my P-40 fuselage before I could break away.

"Later, during that same mission, another Jap came in straight at me – head on!" Hill continued. "I held the machine-gun trigger down. We got closer and closer. I thought we were going to collide, but he just blew up in front of me. I never touched a piece of his wreckage either."

Although Hill identified his victims as Zeroes, other accounts refer to them as a pair of Ki-27s. Chennault also had described enemy fighters as Zeroes, and debate continues as to whether the Flying Tigers actually fought the fabled Japanese plane during their seven months of aerial combat. Some sources support the claim that the P-40 pilots did battle Zeroes, while others assert that the Imperial Japanese Navy had withdrawn its assets from the Asian mainland prior to the AVG's entry into combat. In either case, the majority of enemy fighters that the American pilots duelled in the air above China and Burma were Ki-27s, nicknamed 'Nate' by the Allies, and the Ki-43 'Oscar', a Japanese Army fighter that bore a close resemblance to the Zero – accounting for some confusion.

Through it all, the Flying Tigers' ground crews performed minor miracles, managing to keep enough P-40s in the air to continually battle the Japanese. Damaged planes were cannibalised for spare parts. Supplies were scarce, and

those that did arrive had travelled an immense distance across ocean, by rail, and in the air. Despite having no bomb racks fitted to their planes, the Flying Tigers even improvised some explosives, rigging pipe bombs to parachutes originally intended for flares and filling empty scotch and whiskey bottles with gasoline as makeshift incendiaries.

During an interview with a war correspondent, one Flying Tiger pilot asked the reporter to "save some big words for our ground crews. They have gone through strafings, dodged bombs, and have always been out there working on our planes at all hours".

On 4 July 1942, the American Volunteer Group was officially disbanded. Reconstituted as the China Air Task Force of the US Army Air Forces, the squadrons later joined the 23rd Fighter Group of the 14th Air Force, which subsequently adopted the nickname of the Flying Tigers. Five veteran AVG pilots, including Tex Hill, remained with the 23rd Fighter Group to train new pilots.

Meanwhile, in April 1942, Claire Chennault returned to the Army Air Forces with the rank of colonel, commanding the China Air Task Force. His weathered face made the cover of the 10 August 1942, issue of *Life* magazine. Even though the Flying Tigers had ceased to exist as an independent fighting force a month earlier, their exploits remained popular with the media.

In March 1943, Chennault was promoted to the rank of major general and given command of the 14th Air Force, a post that he held until August 1945. He retired that October and died in Washington, DC, at the age of 67 over ten years later on 27 July 1958.

The legacy of the Flying Tigers is one of grit, determination and bravery against overwhelming odds. Surely this handful of American pilots should continue to capture the imagination today not solely because they dared to take on the Japanese – but also because they consistently bested their enemy in the air.

★ **TIGER** *Roll* **CALL** ★

A number of Flying Tiger pilots achieved success during and after their days with the famous fighter group



BRIGADIER GENERAL DAVID LEE 'TEX' HILL

★ Tex Hill served as both a flight and squadron commander with the Panda Bears and remained in China to train pilots and lead the 23rd Fighter Group of the US Army Air Forces, ending the war with 15.25 aerial victories. After World War II, Hill engaged in mining, ranching and oil speculation. He remained in the Army Reserve

and in 1946 became the commander of the newly formed Texas Air National Guard. Promoted to brigadier general at the age of 31, he was the youngest general officer in the history of the Air National Guard. Hill retired from duty in 1968 and became a frequent guest at air shows and events commemorating the Flying Tigers around the world. In 2002, he received the Distinguished Service Cross for valour, 60 years after the engagement for which he was being recognised. Hill died at his home in Texas in 2007. He was 92 years old.



LIEUTENANT COLONEL CHARLES OLDER

★ A leading AVG ace, Charles Older entered flight training with the US Marine Corps after graduating from college in 1939. He resigned to join the AVG in the summer of 1941 and participated in aerial engagements above Rangoon, Burma, in December.

Flying with the 3rd Squadron, Hell's Angels, Older completed his AVG tour with ten victories. Returning to the US in the summer of 1942, he joined the US Army Air Forces. He later served in China as operations officer and deputy commander of the 23rd Fighter Group. At the end of World War II, he had tallied 18 kills.

After the war ended, Older graduated with a law degree from the University of Southern California. In 1967, Governor Ronald Reagan appointed him to Superior Court in Los Angeles. Judge Older presided over the trial of notorious murderer Charles Manson. He died at his home in Los Angeles on 17 June 2006 at the age of 88.



COLONEL ED RECTOR

★ Ed Rector was serving as a naval aviator, flying from the aircraft carrier USS Ranger, when he resigned his commission to join the American Volunteer Group. Rector scored the Flying Tigers' first aerial victory against the Japanese in combat above the Chinese city of Kunming on 20 December 1941. He was the second-highest scoring ace of the AVG with 10.5 kills and went on to command the 76th Fighter Squadron of the

23rd Fighter Group, shooting down two enemy fighters on 25 September 1942. As commander of the 23rd Fighter Group, he recorded his last kill, and reportedly the last for the unit, on 2 April 1945. Rector remained in China after the war, serving as a military advisor. He retired from the US Air Force in 1962 and worked as an aviation consultant in numerous countries. He died on 26 April 2001 at the age of 84.



MAJOR GENERAL CHARLES BOND

★ A US Army Air Forces pilot, Charles Bond, resigned his commission, arriving in Burma on 12 November 1941, to join the Flying Tigers. He was credited with seven aerial victories and was shot down twice. Some historians credit Bond as the first Flying Tiger to paint the famous shark mouth on his P-40 fighter.

In October 1942, Bond rejoined the Army Air Forces, serving as the pilot for W Averell Harriman, US Ambassador to the Soviet Union. After World War II, he worked as a commercial pilot before returning to the military. In the 1950s, he commanded the 25th and 28th Air Divisions. During the Vietnam War, he led the 2nd Air Division and the 12th and 13th Air Forces.

Bond retired in 1968. In 1984, his book, *A Flying Tiger's Diary*, became a bestseller. Bond served as a consultant for Texas Instruments and died on 18 August 2009, at the age of 94.



COLONEL GREGORY 'PAPPY' BOYINGTON

★ The best known of the Flying Tigers, Colonel Gregory Boyington, served as a flight leader with the AVG and was credited with two Japanese planes. Originally a Marine pilot, Boyington rejoined the Corps in September 1942 and became famous commanding Fighter Squadron 214 (VMF-214), the 'Black Sheep', in the Solomons. At 31, Boyington

was older than the other pilots. They called him 'Pappy'.

Boyington became the top Marine ace of World War II with 28 victories. He received the Medal of Honor for an engagement in which 24 Corsairs shot down 20 enemy fighters with no losses. On 3 January 1944, Boyington had just flamed his 28th enemy plane when he was shot down. He spent 20 months in a prison camp. Boyington retired from the Marines in 1947 and worked at various jobs. The television series *Baa Baa Black Sheep*, more fiction than fact, brought notoriety. He died at the age of 75 on 11 January 1988.



LIEUTENANT COLONEL ROBERT T SMITH

★ Robert T Smith was an early Flying Tiger commitment, resigning from the US Army Air Forces in July 1941. He flew his first combat mission on 23 December, shooting down a Japanese bomber while sharing credit for another. On Christmas Day 1941, Smith shot down three enemy planes. He became flight leader in the

AVG's 3rd Squadron, the Hell's Angels. When the AVG was disbanded, he had tallied 8.9 aerial victories.

Soon Smith returned to the Army Air Forces. He commanded the 337th Fighter Squadron, the 329th Fighter Group, and the 1st Air Commando Group, leading medium bombers and flying fighter escort missions.

After retiring from the military, Smith flew as a commercial pilot, wrote radio scripts, and worked for the Flying Tiger Line, the first air cargo company in the US. He published a book, *Tale of the Tiger*, based on his diaries. Smith died on 21 August 1995, at the age of 77.

"19 FLYING TIGER PILOTS WERE OFFICIALLY CREDITED WITH FIVE OR MORE CONFIRMED AERIAL VICTORIES DURING THEIR COMBAT TOURS WITH THE AVG, ACHIEVING ACE STATUS"



American Volunteer Group pilots make their way to their planes after an air raid siren sounds



A Flying Tiger veteran photographed in front of an image of his comrades, at Kunming Museum, China

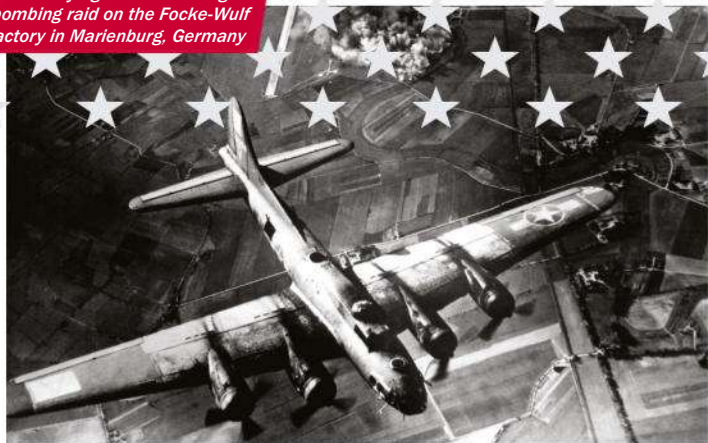


THE MIGHTY EIGHTH OVER EUROPE

Sometimes called the **'MASTERS OF THE AIR'**, American bomber crews faced terrible conditions to win the air war over occupied Europe

★ WORDS: STUART HADAWAY ★

A B-17 Flying Fortress during a bombing raid on the Focke-Wulf factory in Marienburg, Germany



Smoke billows from the Bettenhausen Ordnance Plant in Kassel, Germany, as it's struck in a daylight Allied attack



On 17 August 1942, Major Paul Tibbets led a formation of 12 United States Army Air Forces (USAAF) Boeing B-17E Flying Fortresses into a

bomb-run over Rouen, France. Better known as the first pilot to drop an atomic bomb, on Hiroshima three years later, Tibbets was also the first pilot to fly a USAAF aircraft to bomb Nazi-occupied Europe. It would be the first of nearly 1,000 missions totalling over 600,000 sorties during the war.

At the time of the Japanese attack on Pearl Harbor on 7 December 1941, the USAAF strategic bombing arm was small but growing. America's geographical and political situation (both isolated and isolationist) precluded building an expensive strategic bombing force in the 1920s and 1930s. Although a solid core of its officers desired an independent long-range bombing arm, the Army Air Corps (as it was until June 1941) was firmly part of the US Army. They thought primarily in battlefield terms: investing in short-range tactical aircraft. Changes in naval policy in the early 1930s allowed the bomber supporters to develop a long-range heavy aircraft for maritime reconnaissance and, potentially, attacking enemy fleets. The result was the Boeing B-17. Only in 1938, with war looming in Europe, did US President Franklin D Roosevelt start a

"A PILOT MIGHT FIND HIMSELF RAPIDLY GOING FROM SIMPLY COMMANDING HIS OWN AIRCRAFT TO SUDDENLY FORMING AND TRAINING AN ENTIRE SQUADRON FROM SCRATCH"

programme to expand America's military. This led to the development of the Consolidated B-24 Liberator, an arguably more advanced type but with similar range and speed, although a smaller bomb load. By December 1941 only around 200 B-17s were in service, while the Liberator had just entered service that summer. Curiously, while the RAF progressed through 'generations' of bomber types, the USAAF would keep the same two basic bombers throughout the war over Europe, albeit with various modifications.

Aircraft were just the first of the limitations with which the expanding USAAF bombers had to deal. War brought expansion at an astonishing rate; it was a massive task in administration and training, often relying on personnel with little or no experience themselves. A pilot might find himself rapidly going from commanding his own aircraft to forming and training an entire squadron from scratch. Most rose to the challenge, but not all would find themselves capable.

One of the new units that stood up in January 1942 in Savannah, Georgia, was

the VIII Bomber Command. Its initial roster included just seven men. Within weeks its commander, General Ira Eaker, arrived in England with a small staff, taking up residence with the Air Officer Commanding RAF Bomber Command, Sir Arthur Harris, at High Wycombe. Perhaps contrary to his popular image, Harris welcomed Eaker warmly and provided every facility and support he could. US officers shadowed RAF administrators and staff officers, and accommodation was freely provided. In April 1942 the headquarters of the VIII Bomber Command arrived and moved into Wycombe Abbey School for Girls, a former boarding school where many officers were pleasantly surprised and amused to find bells beside each bed with signs urging them to 'Ring for Mistress'.

Over 100 airfields would also be handed to or built for the American crews. Their UK Air Ministry designs were intended for units with smaller aircraft and smaller crews – four- or five-man RAF medium bombers, or seven men in the new heavies. The American heavy bombers required crews of ten men, and

The Mighty Eighth flew over 600,000 sorties against targets in Europe, dropping 670,000 tons of bombs



Hollywood actor Clark Gable, who served as a gunnery instructor, pictured at the waist gun of a Flying Fortress

Images: Alamy, Getty



Above: A Combat Box of B-17s drop their bombs over Schweinfurt on the ill-fated 17 August 1943 raid

accommodation could be very tight indeed. Nissen huts, wooden framed and covered in thin sheets of corrugated iron, were no match for the British weather, and while most came with at least one stove, fuel was always limited. In fact, despite the US reputation (then as now) for largesse and showering its forces in equipment, even the most basic materials were often in short supply. Huts varied in size and capacity, but the standard furniture for each man was a metal-framed bed, thin mattress and a footlocker. Shelves and pegs above the bed could hold clothing and kit. Ken Blakebrough, a co-pilot with the 457th Bomb Group at Glatton, recalled:

"To me, a Nissen hut during the winter of 1944-45 was a man-made cave. The interior was always gloomy, damp and cold. The windows were covered by thick blackout curtains, the overhead light bulbs, two to a hut, gave scant lighting. The scarcity of coal for the potbelly stove was another reason for avoiding your hut. As a result, the time spent in the hut was mostly for sleeping... There were no chairs, no table."

Ablutions were in separate blocks, often basic and unheated. Some comfort could be found in the communal buildings. Messes for officers, non-commissioned officers and other ranks allowed men to spend off-duty time in slightly more comfortable surroundings, while women had their own messes. Often better-

heated than the Nissen huts, they provided more comfort, including small libraries, recent newspapers and other recreational activities such as darts, pool tables or table tennis. Domestic sites were widely dispersed, though, and could be difficult for ground staff to reach, especially early on when aircraft shortages and high rates of damage meant that long hours were spent repairing each aircraft ready for the next mission.

"OPERATING IN DAYLIGHT, THE USAAF FACED NUMEROUS PROBLEMS AND THREATS, INCLUDING RELENTLESS ENEMY FIGHTER ATTACKS OVER EUROPE AND HEAVY FLAK OVER THEIR TARGETS"

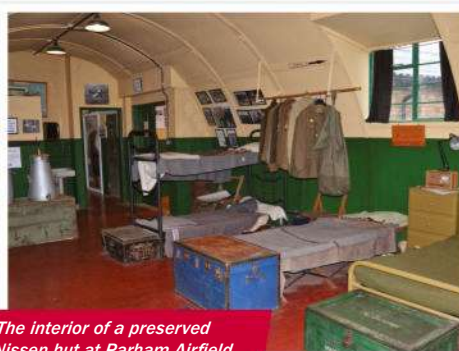
The American Red Cross (ARC) began to set up smaller 'Aeroclubs' scattered around airfields, while the British Navy, Army and Air Force Institutes (NAAFI) continued to provide food outlets, often vans, to allow mechanics in hangars or workshops to grab a bite to eat at their place of work. Later, teams from the Special Service Branch arrived to provide sports equipment and film shows, and many

units began to form their own bands, sports committees and other clubs.

As the airfields became better established, logistics improved and damage rates were reduced, American personnel had greater freedom to obtain passes to leave their camps and explore Britain, enjoying free travel on public transport. Local pubs were always a popular venue, as were nearby towns and, of course, London. The ARC established clubs in many larger towns and cities where personnel could get (initially free, later for a small fee) a proper bed, warm baths, good food and cheap drink, all in as typical an American style as possible, to provide men with a small slice of home while they were overseas.

Although improvements were gradually made over time, living conditions for most were spartan, uncomfortable and with little or no privacy. Aircrews might live in such conditions for a few weeks or several months, until their tours ended one way or the other. Ground staff might spend years living this way.

Operationally, it took time for VIII Bomber Command to build up strength. The industrial might and massive manpower reserves of the United States were producing crews and equipment at an astonishing rate but much of it was being poured back into expanding the training systems. To begin with, those arriving in the UK were mostly replacing losses. Although the bombers were initially limited to raids over France in 1942, mostly targeting the Atlantic



The interior of a preserved Nissen hut at Parham Airfield Museum, Framlingham, Suffolk

An Me 410 sweeps past a B-17's wing tip on a raid over Brux, June 1944



An American and British mechanic at the lower machine gun station of a B-17



The Bloody 100th still proudly bears its wartime markings – the only current US Air Force unit to do so



The Bloody 100th

Tom Hanks' and Stephen Spielberg's TV series, *Masters of the Air*, made its way onto Apple TV+ in 2024 and follows the story of the 'Bloody 100th' Bomb Group (BG), based at Thorpe Abbots in Norfolk. After being formed in Washington State in November 1942, the unit experienced a long period of unrest before deploying. All of the aircrews were temporarily reassigned as instructors on other units between February and April 1943, and then all of the co-pilots were replaced just before their deployment to England in early June. This disruption combined with inexperienced officers and poor discipline to give the unit a bad reputation before it had even seen action.

Once in England, the unit was soon earning a name as a 'bad luck' unit. After taking ten per cent losses on its first operation, against Bremen, the unit enjoyed mixed fortunes. On most raids its losses were no worse, or were even lighter, than other units, but when they did go wrong they went spectacularly so. On the infamous dual raid against Schweinfurt and Regensburg in August 1943, one-in-three of the aircraft lost over Regensburg were from the Bloody 100th. On 10 October 1943, 14 aircraft were despatched to Munster. Two returned early with mechanical faults, the others did not return at all. Yet, four days later when eight aircraft of the 100th BG were among 229 bombers to attack Schweinfurt, they were the only unit not to suffer a single aircraft among the 67 lost or written-off as too badly damaged to repair.

On 4 March 1944, the Bloody 100th was one of two Groups to take part in the first USAAF raid on Berlin, with the 100th losing only a single aircraft. For this, they received a Presidential Unit Citation. Two days later, the 100th returned to Berlin and lost 15 aircraft and crews, their worst losses of the war. This pattern has led one squadron veteran to estimate that 50 per cent of their losses came on just three per cent of their missions.

Today, the Bloody 100th survives as an air-to-air refuelling unit flying KC-135s out of RAF Mildenhall. It's the only modern USAF unit to still bear their wartime Eighth Air Force unit marking – the Square D.

coast U-Boat bases, losses still mounted. Escort fighters were mostly provided by the RAF as the VIII Fighter Command also struggled to get established. When they were available in sufficient numbers, their Lockheed P-38 Lightnings had the range to penetrate deep into enemy territory but lacked performance, while their Republic P-47 Thunderbolts had performance but lacked range until the introduction of drop tanks later in 1943.

Only in January 1943 did the US begin to attack targets in Germany, against coastal towns and harbours. In July 1943 they would make their first deep-penetration raid, attacking the aircraft factories at Kassel and Oschersleben, suffering over seven per cent casualties themselves.

Operating in daylight, the USAAF faced numerous problems and threats, including relentless enemy fighter attacks over Europe and heavy flak over their targets. Their aircraft

were in theory self-defending, being heavily (increasingly) armed, but even so they had to keep in tight formations with overlapping and supporting fire between bombers to be effective at defending themselves.

The basic formation changed as numbers and experience grew, but for most of the war it was the 18-aircraft Bomb Group, consisting of three squadrons each of six aircraft. The squadrons each flew in close formation, and the three were staggered, one above and behind to one side of the lead squadron and one below and behind to the other side. Bomb Groups would then be gathered into a Combat Box, either three Groups staggered in the same pattern as the squadrons or four in a diamond formation. With 54 aircraft a Combat Box covered an area approximately 1,970ft (600m) wide, 2,950ft (900m) high and over 1.25 miles (2km) long. Further Boxes might follow, spaced 3-4 miles (5-6.5km) apart. Inevitably,

A B-24 Liberator drops out of formation after being hit by flak





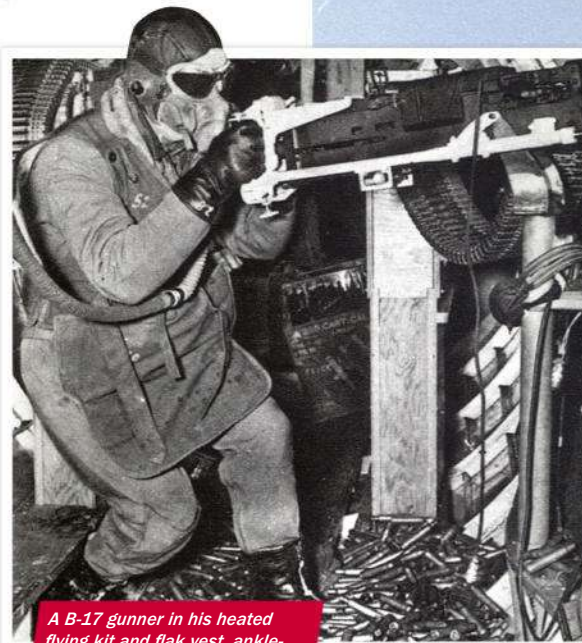
Reverse Lend-Lease

While the flow of American equipment to Britain, the Soviet Union and other Allied nations under the Lend-Lease Act is well known, less celebrated is the Reverse Lend-Lease scheme. Under this, vast quantities of British support was poured into establishing the American air forces and sustaining them.

Of the 133 airfields eventually occupied by the Americans, 119 were built by the UK's Air Ministry; every single one averaged 500 buildings, needed 130,000 tons of concrete and 50 miles (80km) of drainage pipes. Just as American aircraft were delivered to the British, so Supermarine Spitfires and de

Havilland Mosquitos went the other way to VIII Fighter and Bomber Commands, while smaller-scale equipment ranging from aircraft drop tanks to heated flying suits were provided by the RAF. Even 20 percent of the food consumed by the US forces in the UK was provided by the British, despite their own strict rationing.

Technology was also shared. An improved version of H2S ground-imaging radar, H2X, was developed for use in American bombers, while perhaps most outstanding was the production of over 55,000 of the superb Rolls-Royce Merlin engine under licence by the Packard Motor Car Company.



A B-17 gunner in his heated flying kit and flak vest, ankle-deep in spent cartridges

some areas were more vulnerable than others, and the lower edge became known as 'Purple Heart Corner' after the decoration given to men wounded in action. Later, these corners would be reinforced by extra aircraft.

Experience with the difficulties of manoeuvring in formation had quickly led to a policy of 'bombing on the leader'. The lead aircraft in the lead squadron effectively commanded the entire Combat Box, and all aircraft would drop their bombs when they saw the leader drop theirs. Due to this, only the lead aircraft, its wingman and one other aircraft in each squadron was even equipped with a bombsight. It made the Combat Box a very blunt weapon, with little flexibility, and cancelled out much of the increased accuracy that operating in daylight provided.

The massed formations were imposing and could prove very difficult for the German fighters to break-up. They required different strategies than when taking on the RAF. Head-on attacks were a common tactic, while later long-range (unguided) rockets or even bombs were used to try to cause explosions within the formation to loosen them and allow individual aircraft to be picked off. Gunner John Doherty recalled:

"[German fighters] came right through the middle of the formation, trying to peel us out, one or two of them, and the others would be circling to pick out someone who didn't get right back into formation real quick; I was in the waist and they came in so close I could actually see the faces of the German pilots, right outside the wingtip, going through... It was lots of shooting, lots of shooting."

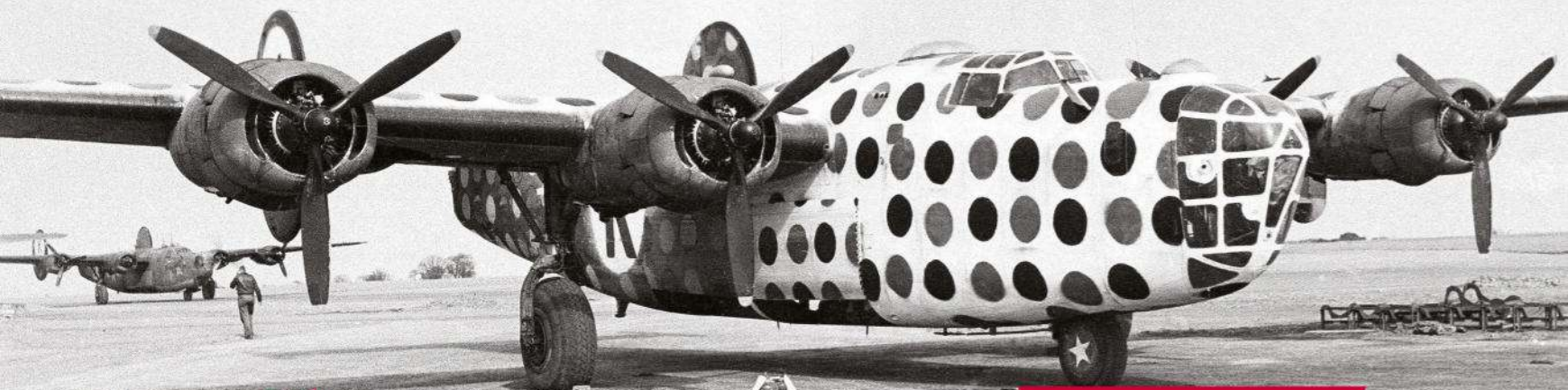


Two staggered Combat Boxes over Wilhelmshaven in November 1943



*The crew of an
Eighth Air Force
B-17 study a map
of their target
before a mission*

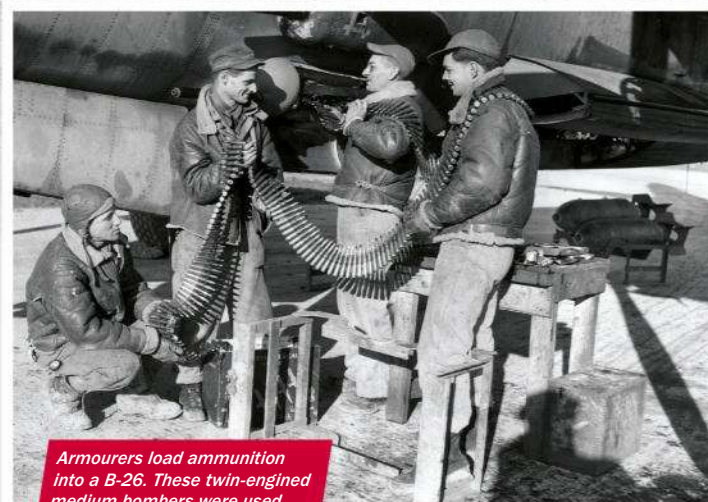




A brightly coloured 'form-up ship' - these were visual references to help in the lengthy process of forming scores of aircraft into a single formation over England



The crew of a Martin B-26 Marauder are pictured in front of their aircraft after completing their 100th mission, June 1944



Armourers load ammunition into a B-26. These twin-engined medium bombers were used extensively during WWII

The close formations also meant that evasive action was difficult, and indeed dangerous. This could be especially nerve-wracking over the target, when anti-aircraft fire ('flak') barrages would appear as a solid mass across the sky ahead. In broad daylight, with no room to manoeuvre, it took incredible courage to fly straight and level. Bob Gillman recalls being 20 miles (32km) from his target at Ploesti:

"We could clearly see some weather ahead over the target, as we could see dark clouds forming. This was strange, since the weather had been so clear... As we got closer, we could begin to see that something was very strange about the cloud formations. They seemed to be constantly moving... Then it hit me! My God, it wasn't clouds at all - but barrage flak!"

Although some flak guns were radar-controlled and could use height and range

readings to target specific formations, even the more random barrages would fill a space with hot metal and tear aircraft to pieces as they flew through. Irving Saarima later described what he saw:

"The flak [over Munster] was about the most vicious I had ever experienced... I levelled my machine gun and kept my head down to get as much protection from them as possible. It appeared as though our bomber was flying in a giant popcorn machine, on high heat... Those ugly black bursts were to be seen flitting by in any direction that I looked. When we landed it was determined that we suffered 18 flak holes."

Sheltering behind his guns would have provided psychological protection at best. Crews were issued steel helmets and 'flak vests' (heavy aprons of overlapping steel

plates covered in fabric) which were surprisingly effective against low-velocity shrapnel, but nothing would save a thin-skinned bomber or its crew from direct hits.

When operating together, the Combat Boxes could be staggered in height from 20,000ft to 30,000ft (6,000-9,150m) in an attempt to thin out the flak. For those at the waist gun positions in particular, which were open on both the early B-17s and B-24s, this led to plummeting temperatures. Jerry Shulman was a B-24 waist gunner:

"You had nothing but fresh air coming in at you... We were flying at 28,000ft [8,500m], the temperature was somewhere about 40 below zero. My hands were so cold I kept them between my legs. Tears came into eyes."

Even in more sheltered parts of the aircraft (or after Plexiglas windows were introduced in the waist) the cold was intense. At these altitudes oxygen was necessary, but even the smallest moisture, including condensation from their own breath, could freeze in the masks and block the pipes, leading to unconsciousness and death. Part of the navigator's task was to talk to each crewmember once every five

**"COULDN'T SLEEP LAST NIGHT. LAY AWAKE SMOKING
UNTIL 5AM... STILL COULDN'T SLEEP. KEPT SEEING FLAK
AND SHIPS EXPLODING"**

minutes to ensure they were still conscious. Considering that missions would routinely be eight to ten hours long, each one became a test of endurance even before the enemy was encountered. Urination was also through rubber pipes, and if they froze, the result, though not fatal, could be very unpleasant.

Crews also had to face the ever-present risk of accidents. The close formations could prove extremely difficult to form, especially in cloudy British skies, and mid-air collisions were far from uncommon. Likewise, an aircraft that had been damaged or was reeling from an attack could easily collide with others in the tightly packed Boxes. Fear of the unknown early on in combat tours was soon replaced with fear of the all-too-well-known. One entry in Ernest Barton's diary reads:

"August 25th. Couldn't sleep last night. Lay awake smoking until 5am... Still couldn't sleep. Kept seeing flak and ships exploding."

Despite its losses, VIII Bomber Command grew from an average of 60-70 aircraft per raid in early 1943 to 600-700 per raid by the end of the year. The VIII Bomber and Fighter Commands were brought together in February 1944 to form the Eighth Air Force. This marked a new level of co-operation between the two, spurred by the arrival in December 1943 of the North American P-51B Mustang.

By coupling the Rolls-Royce Merlin engine with the Mustang airframe, the USAAF had a fighter that could escort the bombers all the way to Berlin, and defeat the Luftwaffe when they got there. Casualty rates, which had exceeded even RAF Bomber Command's in 1943, began to decline. Importantly, during Operation Argument in February 1944 the USAAF and the RAF were able to launch a

series of crushing blows against the German aircraft industry. Around 6,500 sorties were flown, inflicting heavy casualties on the German fighter force while also badly damaging the aircraft factories that could replace them. The resulting weakening of the German air defences enabled Allied air power to be exploited to maximum effect over the following months, laying crucial groundwork in the run up to the Normandy landings.

By 1944, three-quarters of German aircraft production went on fighters, and three-quarters of those were deployed in defence of Germany rather than on the frontlines – a crucial weakness for an army so dependent on tactical air support. Some 55,000 artillery pieces, including 75 per cent of the 88mm guns that were also a formidable anti-tank weapon, were defending German skies. These consumed a third of Germany's artillery production, 20 per cent of all ammunition production, over half of radar and radio production, and kept some two million Germans tied to anti-aircraft defences or repairing air-raid damage, which also consumed vast amounts of concrete, steel and other materials. If these men and materials had been free for deployment on the Eastern, Western or Italian fronts, the Allied land campaigns of 1944 could have turned out very differently.

The personnel of the Eighth Air Force made an immense contribution to Allied victory in 1945. They had to conquer the elements as well as enemy resistance, and their victory cost them dearly. In over 600,000 sorties they dropped over 670,000 tons of bombs. In doing so, 26,000 men were killed and another 28,000 became prisoners of war, while 400,000 well-deserved medals and awards were earned by the men of the Mighty Eighth.

US troops take part in the Wings for Victory campaign, which aimed to raise money for the RAF, 2 June 1943



*Over-sexed,
over-paid and
over here*

The American airmen stationed in the UK had a certain allure. Their pay was generous (a second lieutenant earned three times what their RAF equivalent – pilot officers – made), and their uniforms were high-quality and looked smart compared to the sack-like British battledress. They had access to off-ration supplies, and their exotic accents and habits made them stand out compared to British men, many of whom were overseas anyway.

Sex was an obvious outlet for young men far from home, especially among aircrew, for whom 'hypersexuality' was recognised by US medical authorities as a symptom of combat fatigue. This outlet came with several downsides, including unintended pregnancies, a rise in prostitution and serious venereal disease (VD) problems. In December 1942, their VD rate was 58 in 1,000. By comparison, RAF Bomber Command's was 44/1,000 (itself double that of any other RAF command).

Not all liaisons were fleeting or shallow, and romances were bound to blossom. Estimates vary, but around 45,000 British girls (and 59 British men) married US service personnel during the war. These 'GI brides' were a logistical headache for the American authorities after the war. With the priority being getting their own troops home, it took a while before enough shipping became available to bring the brides and as many as 14,000 children across the Atlantic. After being gathered in camps for processing, in January 1946 Operation War Bride (dubbed 'Operation Diaper Run' in the US press) began when the SS Argentina left Southampton with 452 brides, one bridegroom and 173 children onboard. A further 20 shiploads would follow.



This picture of a B-17 was taken from a German fighter during a raid over Europe, September 1944



THE LEGENDARY
★ RED TAILS



THE LEGENDARY **RED TAILS**

The Tuskegee Airmen overcame enemies at home and abroad to become
**AMERICA'S ONLY ALL-BLACK FIGHTER
GROUP** during World War II

★ WORDS: STUART HADAWAY ★



Images: Alamy, Getty, Wiki



It's not unusual for military formations to have to fight for the resources they need, or perhaps convince hidebound superiors of the validity of new technologies or techniques. Few, however, have ever faced a fight such as the African-American Tuskegee Airmen had to undertake to justify their very right to exist and serve their country.

Despite the "self-evident" facts declared in 1776 that "all men are created equal", the United States of America was riven with racism and prejudice in the 1940s. Segregation was normal in many areas and was rigidly, often violently enforced. African-Americans and other minorities were treated as second-class citizens, with the same nominal rights as white Americans but the clear understanding that they were not the same. Black troops had fought well from the American Civil War to World War I, but bigotry led to moves in the 1920s to limit Black military involvement. Even as America rebuilt its armed forces in the late 1930s, and war in both Europe and the Far East loomed, this vast pool of manpower was dismissed as fit for little more than menial work. When the Civilian Pilot Training (CPT) programme was established in 1938 to train some 20,000 college students for a year as civil pilots to be a ready-made reserve in the event of wartime, it was limited to whites only. It took a further year for the scheme to be extended to Black colleges. Several were authorised to provide basic training and primary flight training, but all advanced training was to be conducted at the Tuskegee Institute in Alabama.

The Institute was founded in 1881 as the Tuskegee Normal School for Colored Teachers by Lewis Adams, a former slave, and George Campbell, a businessman and former slave-owner. Their aim was to improve education standards across the African-American community by training Black teachers, and over time (especially in the inter-war period) the Institute expanded into more vocational and technical subjects. The school still survives today, as the Tuskegee University.

The first CPT entrants began to arrive at Tuskegee in January 1940, and qualified over the summer and autumn. That September, the US introduced the 'draft', calling up selected young men for compulsory military service. But the US Army Air Force (USAAF) did not have any Black flying units and, as numbers of qualified pilots from Tuskegee grew, there was increasing pressure to create such a unit to take advantage of this new resource. A Black unit was finally authorised in December 1940; it would be totally segregated with entirely Black personnel (beyond a few senior white officers and instructors). The aircrew were trained at the newly formed Tuskegee Army Air Force base, and the Black ground crews at Chanute Field, Illinois. Designated the 99th Pursuit (later Fighter) Squadron, the unit would take 15 months to achieve even

limited operational status, as obstacles were constantly thrown in its path. It took nearly a year to complete the facilities at the airfield, while prospective trainees found enlisting far harder than they had anticipated.

One of the first volunteers was Benjamin O Davis Jnr, a graduate of the US Military Academy at West Point (where his time had been a constant struggle against racism), and son of the only Black general in the US Army. In fact, after his graduation and joining the

"WE CALLED THEM THE RED TAILS. BOY, WE FELT GOOD WHEN THE RED TAILS WERE WITH US"

infantry, Benjamin O Davis Snr and Jnr were the only two Black officers in the US Army outside the Chaplains Department. Davis applied for flight training and was sent to Fort Riley, Kansas, for assessment. He would later recall: "The flight surgeon who gave me the exam did what all flight surgeons were doing when they had Black applicants. He wrote down that I had epilepsy, and I was not qualified for flying training." Such tricks were far from uncommon, with many officers and officials at all levels doubting that African-Americans had the intelligence or aptitude to make good pilots. Davis was then sent to an air base in Alabama for re-testing, and passed.

He and 12 others arrived at Tuskegee in July 1941 to form the first class and start training. Five would successfully qualify the following March, followed by more classes over the coming months.

On base, the pilots faced segregation and prejudice. George Boyd, who would go on to serve until 1970 and see combat in the Korean and Vietnam Wars, recalled: "There were certain things you did based on custom and what was safe... That was part of growing up Black... You were afraid of doing something that'd get you harmed even though you weren't breaking the law."

Airfield facilities were divided into 'coloured' and 'white', and Black personnel were banned from the latter. Thankfully for the trainees, base commander Lieutenant Colonel Noel Parrish was a supporter of equality and did all he could to impose fair treatment and mitigate the worst of the bigotry, integrating facilities as much as possible.

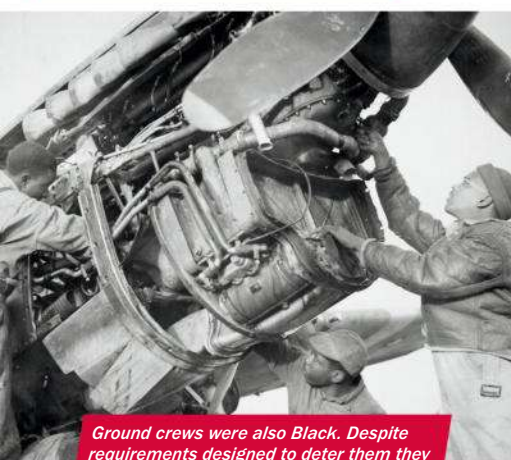
The 99th Fighter Squadron (FS) became operational in July 1942, commanded by the newly promoted Lieutenant Colonel Benjamin Davis. Over the following months they built up their strength and experience, flying worn-out Curtiss P-40 Warhawks. As more pilots graduated, the 100th Fighter Squadron also began to form. In March 1943 the 99th FS was ready for deployment, and in April it arrived in Casablanca, Morocco. After two months operational training, the squadron joined the 33rd Fighter Group (FG).

The 33rd FG was commanded by Colonel





A P-51C Mustang painted in the distinctive Red Tail markings of the 332nd Fighter Group – the Tuskegee Airmen



Ground crews were also Black. Despite requirements designed to deter them they had a very high standard of technical staff



Trainee airmen undergoing Morse Code training at Tuskegee Army Air Force base

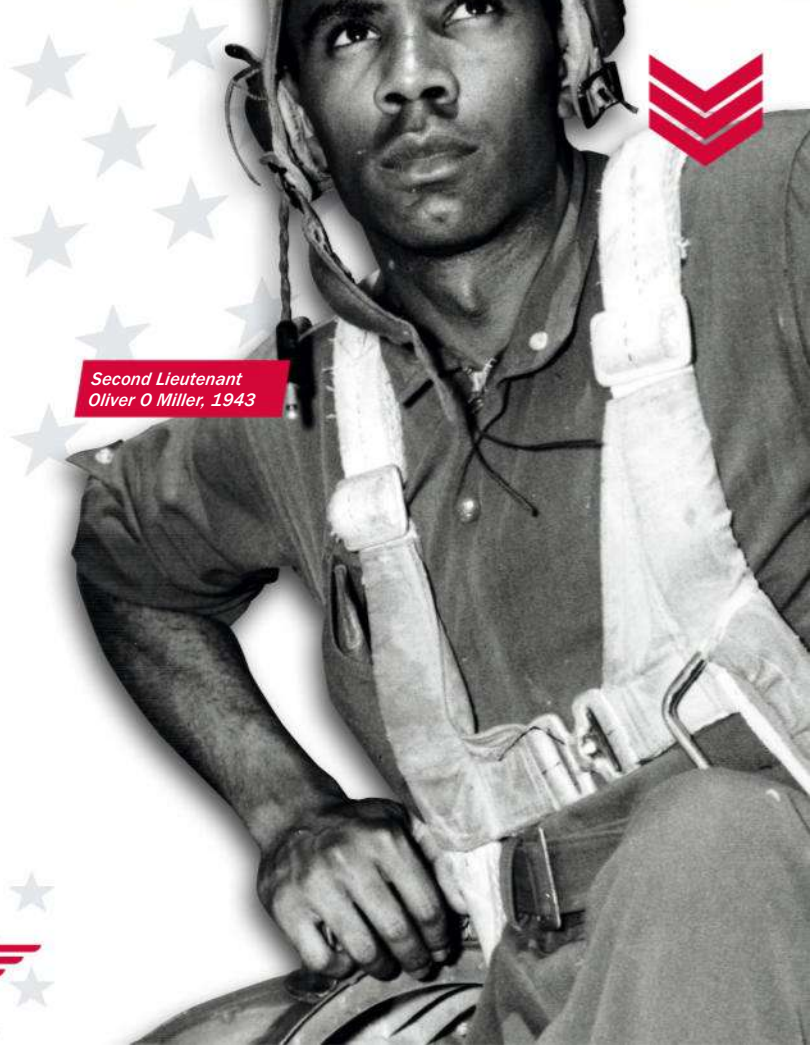
Being black in Britain

The British took a very different approach to Black and ethnic minority personnel

Although the Royal Air Force (and its precursor, the Royal Flying Corps) had had several Indian and West Indian officers serve during World War I, during the inter-war period a 'colour-bar' had operated, banning officers of 'non-European descent'. This was lifted in October 1939, and hundreds of Black and Asian personnel would serve as aircrew, and thousands as ground crew, during the war. Primarily from the West Indies, men and women also came from India, Africa, and even Burma and China. All were fully integrated into their units and their crews, and there were no restrictions on their receiving command positions. However, there were some restrictions to prevent ethnic minority personnel being

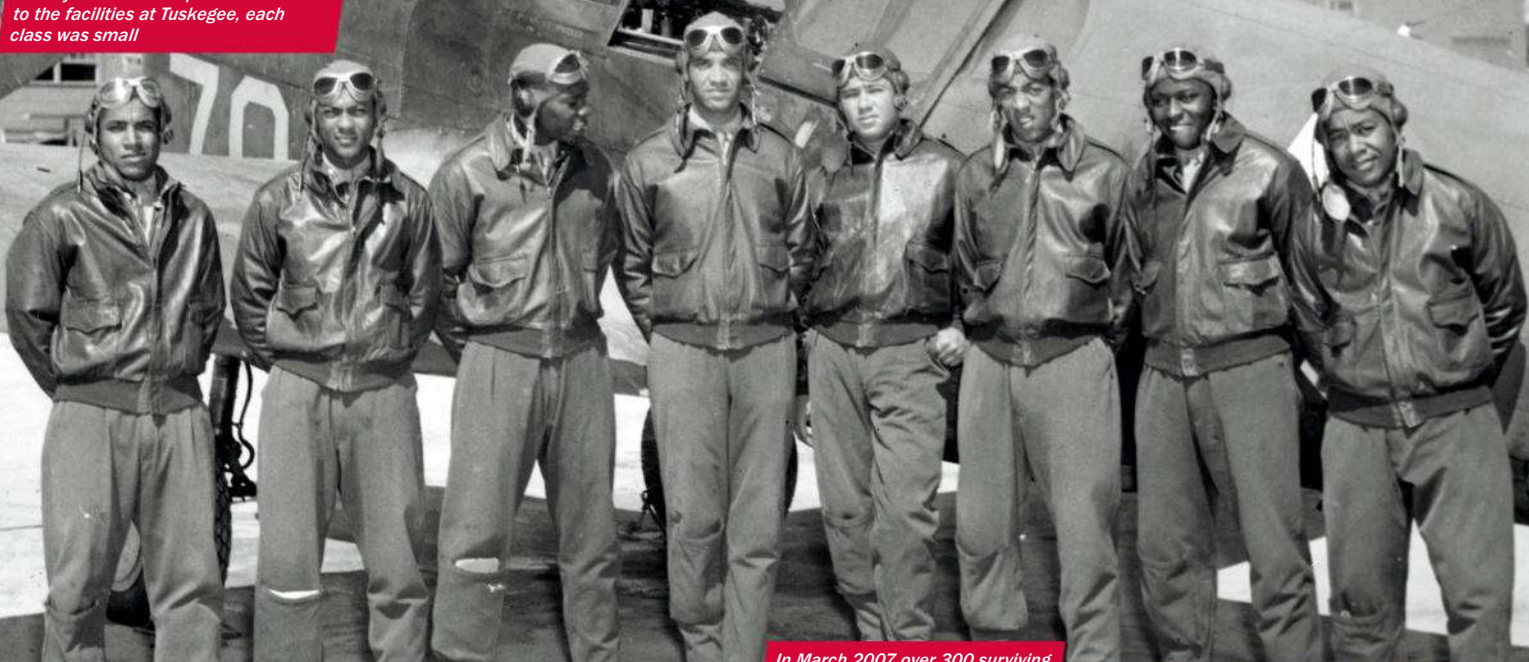
posted to areas where they might face racial discrimination such as the United States of America or the Union of South Africa.

When American forces began arriving in Britain in 1942, British society was welcoming to all, often to the dismay of US authorities. Attempts to enforce racial segregation in pubs and other recreational facilities near American bases were often met with obstruction and outright hostility by local people, and by the members of the British armed forces. On more than one occasion rioting and violence broke out when American military police attempted to enforce racist policies that the British neither recognised nor wanted.



Second Lieutenant
Oliver O. Miller, 1943

A class of airmen await their 'Wings' as a symbol of their qualification. Due to the facilities at Tuskegee, each class was small



In March 2007 over 300 surviving Tuskegee Airmen gathered to be awarded the Congressional Gold Medal for their extraordinary contributions to their country



Airmen getting navigation training. All instructors were white to begin with, until enough Black officers were deemed to have the necessary skills and experience

The Tuskegee bomber boys

Less famous than the legendary Red Tails, there was also a Black Bomb Group



While the 332nd Fighter Group are the best-known of the Tuskegee airmen, there was also the 477th Bombardment Group (BG). Formed in January 1944 at Selfridge Army Air Field, Michigan, the unit moved several times. The unit never saw combat with the enemy, but instead became embroiled in constant conflict with its own side. Always understrength, not least because of long delays in authorising the training of Black personnel as navigators and bomb-aimers, the Group's own chain of command was determined that it would not be a success.

Colonel Robert Selway, who had briefly commanded the 332nd FG, was the commander of the new Group, and he went to great lengths to enforce segregation and the isolation of

the Black crews. In this he was supported by the commander of the First Air Force, General Frank Hunter, who was an ardent segregationist, while even General Hap Arnold, commander of the USAAF, was against the unit from the start. In December 1944, at Freeman Field, Indiana, Selway attempted to formalise the unofficial segregation on the base, in contravention of Army regulations, leading to over 100 Black officers refusing orders and being arrested. A Committee on Special Troop Policies investigated the matter. All but three were released without charge, and only one of them was convicted of a crime. Soon after, Benjamin O Davis was brought from the 332nd FG to take command of the 477th. The Group was treated better from then on.



William Momyer, who made no secret of his disapproval of the 99th. Despite the Group's four squadrons all operating from the same base, Momyer ignored the 99th FS and isolated them as much as possible. Despite this hostile welcome the 99th FS went into combat over the Mediterranean island of Pantelleria in June, conducting dive-bombing and ground-attack sorties, and escorting medium bombers. At the end of June the squadron was relieved to leave the 33rd FG, joining the rather more welcoming 324th FG to take part in the invasion of Sicily. Again, the squadron flew ground attack and escort sorties, and on 2 July they achieved their first aerial victory when Lieutenant Charles Hall shot down a German Focke-Wulf Fw 190. They completed a total of 175 combat sorties over Sicily in just 10 days and were awarded a Distinguished Unit Citation for their efforts.

On 19 July 1943, the 99th FS was posted back to the 33rd FG, and the unit started perhaps the hardest part of their war. Again ostracised by their commander and the rest of the Group, in September they also lost their excellent commanding officer when Davis was posted back to the US to take command of the newly forming 332nd FG, composed entirely of Black units. That same month, Colonel Momyer wrote a damning report on the performance of the 99th FS, which went all the way to the top. Eventually the Chief of Staff of the US Army, General George C Marshall, ordered the War Department to investigate Momyer's accusations of poor performance. It would take five months for the investigation, which exonerated the 99th FS on all counts, to be published.

In October some relief came as the 99th FS was again posted, to the 79th FG. Here they received a warm welcome from Colonel Earl Bates who, in stark contrast to Momyer, extended every courtesy and facility to the squadron. The units became fully integrated, even to the extent that 99th FS pilots led flights and formations, something that Momyer had forbidden as it put white personnel under the command of Black men. However, poor weather and monotonous patrols slowly eroded morale, as did the lack of further air-to-air combat success. To make matters worse, the unit was given apparently lesser duties during the landings at Anzio in January 1944, flying patrols over the invasion fleet rather than on the front lines. This duty was turned to stunning advantage on 27 January, when 15 Fw 190s were spotted attacking Allied shipping. The 99th FS intercepted them and despite being heavily outclassed by the newer, faster Fw 190s the Tuskegee men in their aged P-40s shot down five enemy aircraft and damaged five more, for the loss of two of their own. The following day, three more German aircraft were shot down, and morale in the 99th FS rocketed. They had proved their worth

as fighter pilots.

Their run of luck continued through February, and in March they were delighted to be posted back to the 324th FG. They shared in the

Group's successes over Anzio and Monte Cassino, and in their resulting Distinguished Unit Citation. Then, in June, came a move that was strangely not as popular as might have been expected.

In January 1944, the 332nd FG had arrived in Europe, consisting of the 100th, 301st and 302nd FSs. All of them were Black units, drawn from some of the nearly 1,000 Black airmen trained at Tuskegee through the war. Equipped with the obsolete Bell P-39 Airacobra, they had been relegated to coastal patrols until May 1944, when they started to re-equip with the modern Republic P-47 Thunderbolt. The 99th FS gave up their P-40s to receive P-47s as they joined the Group, but despite this many pilots were discontented. They had been proving themselves as part of otherwise all-white units, and saw being sent to the all-Black 332nd FG as a step backwards, a reinforcement of the military's segregation policies.

The 332nd FG were one of four FGs in the Fifteenth Air Force. Each FG had a different pattern on their tails for recognition, and the 332nd's all-red tail markings led to their new nickname: the Red Tails. They were engaged on a mixture of tactical operations, supporting ground units in Italy and the Balkans (even supporting Red Army units in the latter), and strategic operations escorting heavy bombers over France, Italy, Romania, the Balkans and into Germany itself. In July 1944, the Group began converting aircraft type again, receiving North American P-51C Mustangs.

The Red Tails really began to win a reputation during the escort operations that made up over half of their tasks. The heavy bombers of the Fifteenth Air Force flew long distances, with the various FGs providing escort on different parts of the routes. The Red Tails soon gained a name for themselves as efficient escorts. GC Barnett, a B-24 Liberator co-pilot, recalled: "Maybe we should've called them the Red Barons, but we called them the Red Tails. They were always in position where we thought fighter escort should be, not too far out, and not too close – right out where we liked to see them... Boy, we felt good when the Red Tails were with us."

Escorting was unglamorous work and required strict discipline. The fighters needed to stick with the bombers, seeing off enemy fighters without getting drawn off by them and leaving the bombers undefended. The Red Tails developed a reputation for not being easily drawn away. This meant that their overall aerial victory rate remained relatively low, but they kept their bombers safer. There is a myth that the Red Tails never

lost a bomber they were escorting but this is not true – at least 27 can be traced as lost on their watch, including 15 on 18 July 1944 alone. However, from 24 August 1944 through to 24 March 1945 the Red Tails did fly over 100 bomber escort operations without losing a bomber, which was no mean feat.

A high point of the Red Tails' service came on 24 March 1945, with the longest distance raid ever flown by the Fifteenth Air Force: a 2,600km round trip to Berlin. The Red Tails were due to take over escort duties for the last leg of the outward trip, handing over to the next FG as they reached Berlin. In fact, the relief escorts did not show up, and Davis opted to remain with the bombers as they made their bombing run over the German capital. There, the formation was attacked by Messerschmitt Me.262 jet fighters and the Red Tails downed three of them in the ensuing dogfight. For their performance, the 332nd earned their first (but the 99th FS's third) Distinguished Unit Citation.

After the end of the war, the 332nd FG returned to the US and was deactivated, with the 99th FS joining the 477th BG to form the 447th Composite Group, under Davis' command. They now faced fresh prejudice and discrimination. Jefferson Alexander had been a POW, and had found that the Nazis had treated him just like any other US officer. He now found himself being denied the use of the 1st Class carriages on trains, an experience shared by many others, regardless of their uniforms, medals and war service.

However, in part due to their service, things were changing. When the United States Air Force became an independent service in 1947, it lost no time in beginning the process of desegregating. Integration became official USAF policy in 1948, even before President Truman announced that it would be introduced across the armed forces. Some of the Tuskegee airmen would go on to illustrious careers in the USAF. Davis, for example, became its first Black general, commanding a wing in the Korean War, then holding higher command in Europe. More still left the military, and with their training, experiences and confidence joined the growing Civil Rights movement. In 2007 the Tuskegee Airmen were presented with the Congressional Gold Medal, in recognition of their service.



Tuskegee Airmen being briefed for an operation in Italy, March 1945

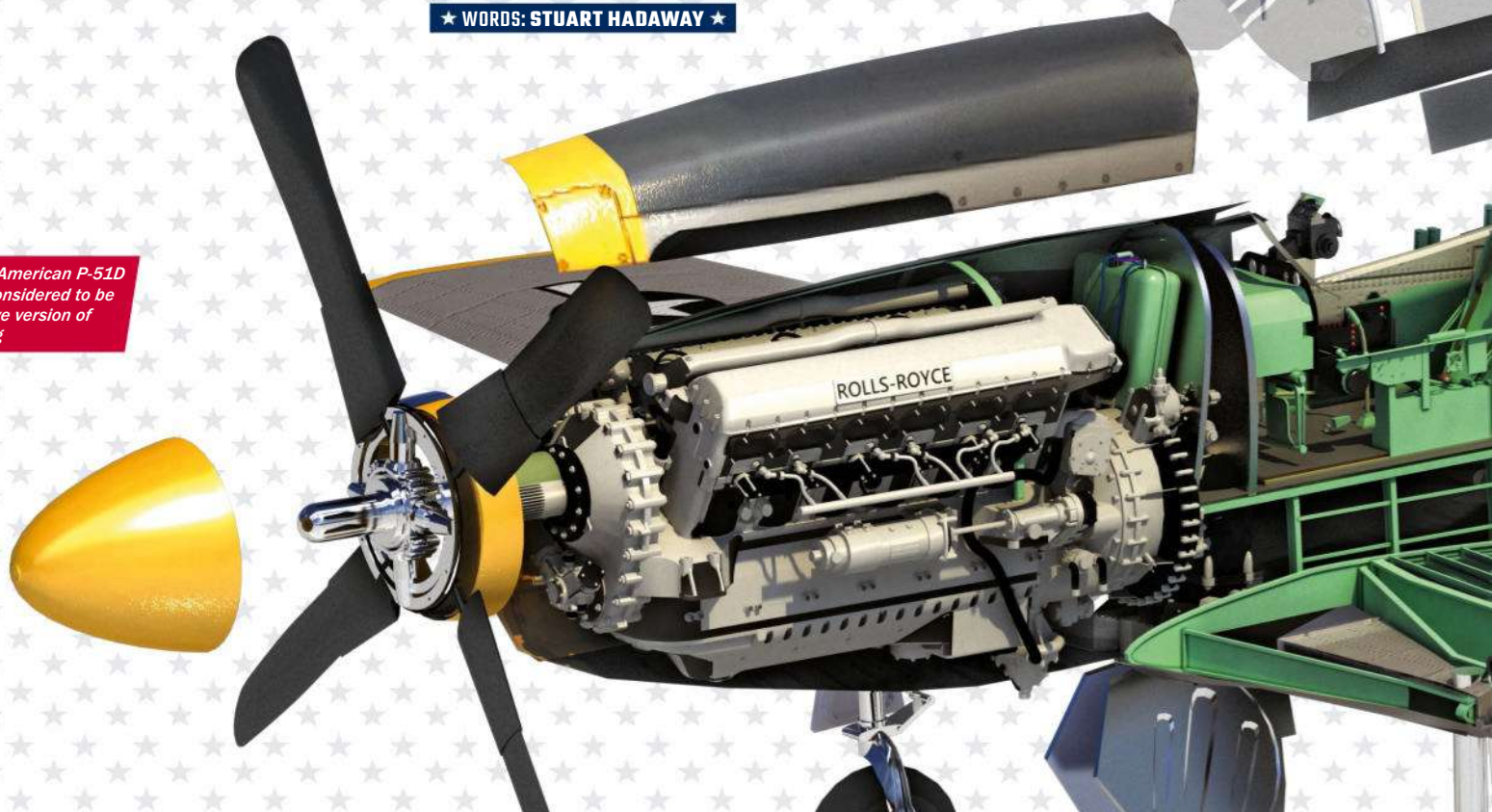


NORTH AMERICAN P-51 MUSTANG

Despite an unpromising start, the Mustang became a **WORLD-CLASS FIGHTER** and the aircraft that **DESTROYED THE LUFTWAFFE**

★ WORDS: STUART HADAWAY ★

The North American P-51D is widely considered to be the definitive version of the Mustang



he P-51 Mustang is one of the greatest fighter aircraft of all time and played a definitive role in winning the air battle over Europe during World War II.

The initial models with Allison engines had poor high-level performance but excellent lower-level characteristics. When it first entered service with the RAF in January 1942, the P-51 Mustang was used mainly for photo-reconnaissance sorties, which rapidly evolved to also include ground-attack sweeps.

Meanwhile, the USAAF became interested in the P-51. As the USAAF doctrine of self-defending bombers was proven unsound, it looked for a long-range escort fighter. The Allison-engined P-51A would not do, but the new P-51B, with a Merlin engine and

drop-tanks fitted the bill perfectly, and large numbers were ordered. These arrived with the Eighth Air Force in the UK in December 1943. In January 1944 Mustangs made their first sortie over Germany, and in March operated for the first time over Berlin. The improved P-51D became the Eighth Air Force's primary fighter in 1944. From close bomber escort work they expanded into 'sweeps' across Germany and occupied Europe, systematically destroying the Luftwaffe in the air and on the ground. The P-51 would destroy more German aircraft than any other Allied fighter, and over 250 USAAF pilots scored five or more victories while flying the Mustang.

The P-51 played a lesser role in the Far East, although it was used by the Chinese Nationalists, and in 1945 flew escort operations for USAAF B-29 Superfortresses over Japan.



**"THE P-51 WOULD CLAIM MORE
GERMAN AIRCRAFT DESTROYED
THAN ANY OTHER ALLIED FIGHTER"**

NORTH AMERICAN P-51D MUSTANG

COMMISSIONED:	1940
ORIGIN:	USA/UK
LENGTH:	9.83M (32FT 3IN)
RANGE:	1,530KM (950 MI) ON INTERNAL TANKS
ENGINE:	1,490-HORSEPOWER, LIQUID-COOLED, V-12 PACKARD MERLIN
CREW:	1
PRIMARY WEAPON:	6 X BROWNING .50-CALIBRE MACHINE GUNS
SECONDARY WEAPON:	2 X 454KG (1,000LB) BOMBS OR 10 X 127MM (5IN) ROCKETS



"WHEN THE USAAF ADOPTED THE AIRCRAFT THE NOSE GUNS
DISAPPEARED (AS THEY QUICKLY DID IN RAF SERVICE) AND ARMAMENT
CHANGED TO FOUR 20MM HISPANO CANNON IN THE WINGS"

*Armourers prepare to load
a Mustang's six .50-calibre
machine guns. 36 such belts of
ammunition would be needed*

ARMAMENT ★

Early RAF models had four Browning M1919 .30-calibre and two Browning M2 .50-calibre machine guns in the wings, and another two .50-calibre machine guns in the nose. When the USAAF adopted the aircraft the nose guns disappeared (as they quickly did in RAF service) and armament changed to four 20mm Hispano cannon in the wings. Various other changes occurred in new models, but the P-51D/Mustang IV had six M2 Browning .50-calibre machine guns, and bomb racks under each wing capable of carrying 1,000-pound bombs. Up to ten 127 mm (five-inch) rockets could also be carried.



*P-51 bombs flanked by the
all-important fuel drop-tanks,
which gave the Mustang the
range to fight over Germany*

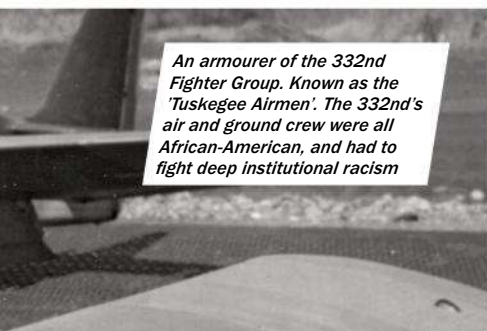
Three P-51Ds and a P-51B of the 375th Fighter Squadron, 361st Fighter Group, over France, July 1944



Rockets stacked on an airfield, ready for use



An armourer of the 332nd Fighter Group. Known as the 'Tuskegee Airmen'. The 332nd's air and ground crew were all African-American, and had to fight deep institutional racism



A P-51 drops napalm over a North Korean town during the Korean War

DESIGN ★

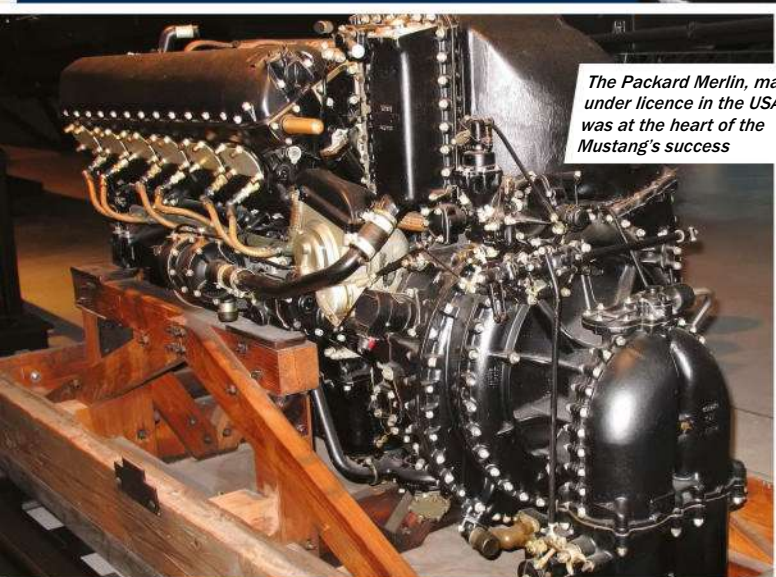
The P-51 was designed to RAF specifications. After the concept design was approved and an order placed on 29 May 1940, the prototype rolled out just over 100 days later (though the engine took another month). The Mustang was lightweight aluminium, with an aerodynamically placed ventral radiator and efficient, laminar wings. Early versions had blocky, three-panel hinged cockpits, later changed by the RAF (and on some USAAF aircraft) to Spitfire-style bulbous 'Malcolm Hoods'. When the P-51D/Mustang IV was being designed, the classic tear-drop canopy (inspired by the Hawker Typhoon) was added, giving an excellent all-round view and improved aerodynamics.



One of the many P-51s still flying around the world today

ENGINE ★

The engine was the key to the Mustang's success. It was originally fitted with the 1,150-horsepower Allison V-1710-39 liquid-cooled V12, which provided great low-level performance but was poor above 15,000 feet. Then, in mid-1942 Rolls Royce test pilot Ronald Harker asked to put a Merlin engine in a Mustang. After a long struggle he was allowed, and a truly superb fighter was born. Equipped with the US-made 1,300-horsepower Packard Merlin V-1650-3 liquid-cooled V12, with two-stage supercharger, the Mustang had excellent performance at all levels and could escort heavy bomber raids and confront the Luftwaffe head-on.



The Packard Merlin, made under licence in the USA, was at the heart of the Mustang's success

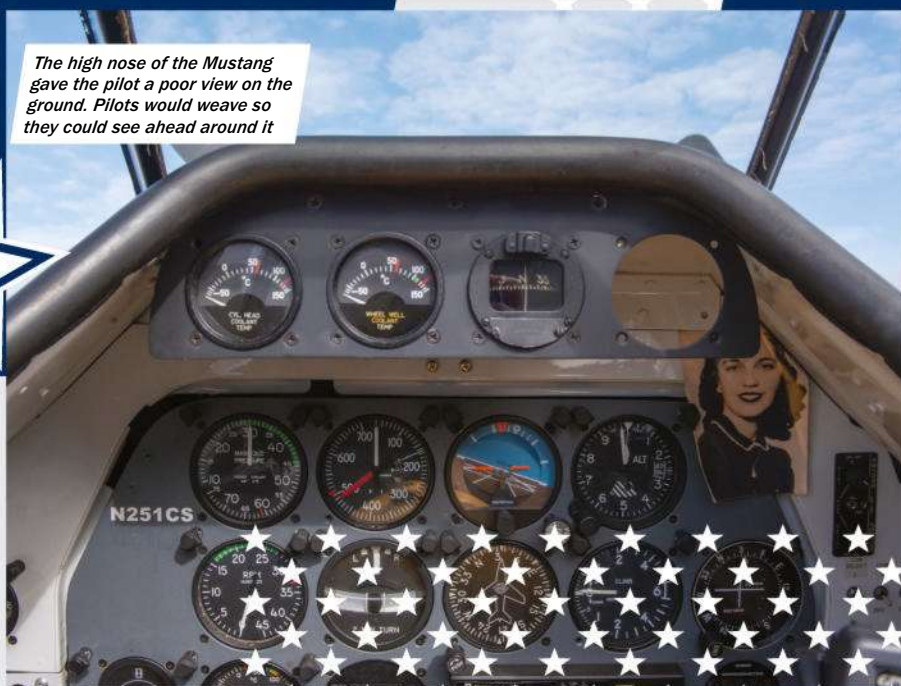


The smooth aluminium finish on the Mustang increased its speed by several kilometres per hour, while the black section across the top of the nose stopped reflections from dazzling the pilot

COCKPIT ★

Small like all fighter cockpits, Mustangs had the standard flight instruments in front of the pilot. On the left side of the cockpit were the throttle, propeller and mixture controls, drop-tank switches, trim controls and undercarriage lever. On the right side were the electronics switches and dials underneath the VHF radio and Indicator Friend or Foe controls. Crucial to high-altitude operations over Europe, at the front right corner of the pilot's seat was the hot air vent (twist clockwise for more heat) and at the front left corner the defroster control to clear the windscreen.

The high nose of the Mustang gave the pilot a poor view on the ground. Pilots would weave so they could see ahead around it



The cockpit of the Mustang: compact, efficient, but uncomfortable for the long-duration flights of escort fighters

SERVICE HISTORY ★

LEGEND HAS IT THAT LUFTWAFFE CHIEF HERMANN GÖRING SAID, "THE DAY I SAW MUSTANGS OVER BERLIN, I KNEW THE JIG WAS UP"

The P-51A (US designation)/Mustang I (RAF designation) entered service with the RAF in January 1942. Its excellent low-level performance made it ideal for photo-reconnaissance and ground attack work over occupied Europe, although the RAF occasionally used them as fighters.

It was the P-51B/Mustang III that became the first true fighter version, when the Allison engines were replaced by Merlins. Other improvements were also made, and this type entered front-line service with the USAAF Eighth Air Force in the UK in December 1943. A few months later, the further-improved P-51D/



A taxiing Mustang being directed over a steel matting runway on Iwo Jima, 1945

Mustang IV with the classic teardrop canopy arrived. This type rapidly became the Eighth Air Force's main fighter, with the range and performance to escort American bombers deep into Germany and take on the fighters of the German air force.

Although later, more powerful models such as the P-51H were developed, the P-51D remained



A flight of Mustangs over Ramitelli air base, Italy, March 1945

the definitive version, being used by the USAF during the Korean War and only being withdrawn from front-line service in 1953. Nearly 30 air forces around the world used P-51s, in over 20 variants. The Dominican Air Force was the last to retire the Mustang from service, in 1984, although many examples still fly around the world in private hands.

USAAF F-6As, the reconnaissance version of the P-51, photograph a Normandy beach prior to the invasion



"ITS EXCELLENT LOW-LEVEL PERFORMANCE MADE IT IDEAL FOR PHOTO-RECONNAISSANCE AND GROUND ATTACK WORK OVER OCCUPIED EUROPE"

Yeager named many of his aircraft after his wife Glennis, including the one that broke the speed of sound

Yeager (left) next to Major Gus Lundquist, Captain James Fitzgerald, and 'Glamorous Glennis'

The rocket engine-powered Bell X-1 became the first aircraft to achieve supersonic flight



A LIFE'S WORK

The journey to becoming the 'Fastest Man Alive'

★ 1941 ★

Yeager graduated from Hamlin High School six months before America entered World War II, joining the Army Air Corps.

★ 1923 ★

On 13 February, Charles Elwood "Chuck" Yeager was born in Myra, West Virginia.



Chuck Yeager

The man who made history by **BREAKING THE SOUND BARRIER**



Charles "Chuck" Yeager was born in Myra, West Virginia, in 1923 – the second of five children of Albert Hal and Susie Mae Yeager. The family moved to the small town of Hamlin

when Yeager was five, which at the time had only around 600 residents. Yeager's father owned a natural gas-drilling business, which meant Yeager learned all about the mechanics of generators, pumps and regulators at a young age, which transferred into his aptitude for mathematics. Yeager ended his formal education after high school and joined the Army Air Corps in 1941, only months before the attack on Pearl Harbor. He had originally joined to work on the engines of planes, but by the following year he had been selected to join the flight training program. Yeager's start in the skies wasn't smooth; some reports say he wasn't keen on leaving the ground as his first flights made him queasy. But that must have been short-lived, as by 1943 he had been awarded his pilot's wings.

Joining the fighting ranks during World War II, Yeager travelled to England as part of the Eighth Air Force to pilot a P-51 Mustang, which he named 'Glamorous Glen' after his future wife Glennis Dickhouse. He entered combat in February 1944, but on his eighth mission was shot down. He evaded enemy capture with the help of French allies and returned to England.

Yeager rejoined combat until January the following year, taking part in 61 missions, before joining the US Air Force test pilot school. After two years, Yeager had been handpicked by the chief of the Flight Test Division, Colonel

Albert Boyd, to join the X-1 program. The program sought to break the sound barrier in the rocket-powered Bell XS-1 aircraft, which Yeager christened 'Glamorous Glennis'.

Having spent around a year in the program and with several high-speed test flights under his belt, it was on 14 October 1947 that Yeager achieved what no one had done before. After dropping out of the bomb bay of a Boeing B-29 Superfortress aircraft, Yeager kick-started the X-1's engines and rapidly accelerated to 0.98 Mach at around 13,100 metres in the air. Suddenly, the needle of his Machmeter swung off the scale, and a roaring sonic boom dominated the airwaves. The deafening sound signalled that Yeager had reached over Mach 1, around 700 miles per hour, and was flying quicker than the speed of sound.

Following his sound barrier-breaking success, Yeager continued as a test pilot and even acted as an adviser to the Pakistan Air Force before he retired from the US Air Force in 1975, leaving under the rank of brigadier general.

Breaking barriers

The speed of sound, which we refer to as Mach 1, is approximately 770 miles per hour at sea level, and an object approaching this speed will experience a sudden increase in aerodynamic drag caused by the 'sound barrier'. This phenomenon occurs because of the compressed air, sound waves and forces such as drag generated by the fast-moving object.

The sound barrier had been broken by human-made objects hundreds of years before Yeager set foot in the cockpit of a plane – bullets and cannons – and by whips thousands of years before that. What makes Yeager's achievement so monumental is that he showed the human body could withstand the forces when travelling at speeds faster than sound. This achievement ultimately paved the way for space travel and the creation of the US space program.



When an aircraft breaks the sound barrier a 'vapour cone' or 'shock collar' forms from water droplets getting trapped in high-pressure airflow

★ FIVE THINGS TO KNOW ABOUT... CHUCK YEAGER ★

1

SILVER SCREEN

Author Tom Wolfe wrote Yeager into his 1979 novel *The Right Stuff* and subsequent film of the same name, which explored the early days of the Space Race.

2

SHARPSHOOTER

During World War II, it's reported that Yeager shot down 13 enemy planes – five in a single day.

3

OVERACHIEVER

In 1953 he surpassed his groundbreaking achievement by travelling at more than double the speed of sound, Mach 2.44 (1,650 miles per hour).

4

DELAYED ANNOUNCEMENT

It wasn't until June 1948, roughly eight months after the fact, that Yeager's achievement was revealed to the world. He was quickly branded the 'Fastest Man Alive'.

5

HE DID IT WITH BROKEN RIBS

Days before his historic flight, Yeager fell off a horse and broke two of his ribs. Because of the pain he had to use a sawn-off broomstick inside the cockpit to shut the plane's canopy.

★ **1947** ★

In August, his first rocket-powered flight reached Mach 0.85.

★ **1949** ★

He became the first American to takeoff in a rocket-powered aircraft from the ground.

★ **1966** ★

He assumed command of the 405th Fighter Wing at Clark Air Base, the Philippines, where he flew 127 missions in South Vietnam.

★ **2020** ★

On 7 December, Yeager passed away aged 97.

★ **1943** ★

On 10 March he earned his wings at Luke Field, Arizona.

★ **1947** ★

In October, he broke the sound barrier in the Bell X-1 aircraft.

★ **1958** ★

Yeager became commander of the 1st Fighter Squadron, flying the new North American F-100D Super Sabre.

★ **1976** ★

Yeager was awarded the Special Congressional Silver Medal for bravery.

Images: Getty



TARGET RED

Created in 1947 as the Cold War emerged, the US Air Force was heavily engaged in the next half century of **MILITARY AND IDEOLOGICAL RIVALRY**

★ WORDS: MICHAEL E HASKEW ★



Unprecedented in length and scope, the Cold War, which defined the second half of the 20th century, was a period of continual activity for the US Air Force.

The Air Force was established in 1947 just as the Cold War, an ideological, diplomatic and military contest that lasted roughly 50 years, took shape. Within five years of the end of World War II, the tenuous alliance between the East and West – namely the Soviet Union and the United States and Great Britain – had begun to unravel. With Soviet support, communist North Korea invaded democratic South Korea in June 1950, sparking a United Nations-supported military effort to eject the invaders.

The US Air Force initiated its operations during the Korean War early in the contest, flying bombing missions with four-engine heavy Boeing B-29 Superfortresses flying from bases in Japan and the islands of

Okinawa and Guam. However, the advent of the jet aircraft in service brought a direct threat to the B-29s. Soon enough, Soviet-built MiG-15 fighters and US pilots flying the North American F-86 Sabre tangled over Korean territory. The air battles were often intense, particularly in an area nicknamed 'MiG Alley'. Air Force Captain Joseph McConnell emerged from the conflict as the top scoring American ace with 16 victories. Some of the communist fighters engaged were covertly flown by experienced pilots of the Soviet Red Air Force.

During the Korean War, the US Air Force deployed an estimated 1,172 combat and support aircraft. Early in the conflict, nearly 37,000 active duty personnel were in the region. This number steadily climbed, and well over 200,000 reservists were called up as well.

American involvement in the long Vietnam War escalated steadily during the 1960s and eventually included roughly 100,000 Air Force personnel at any given time. Through the end of US involvement, Air Force pilots and crews flew an estimated 5.25 million combat and

supply missions. American fighters occasionally tangled with North Vietnamese pilots flying Soviet-built MiG-21s and other types, while the pilots and crews encountered some of the most concentrated air defences in history. Soviet-supplied surface-to-air missiles claimed many of the 1,737 Air Force planes lost in the Vietnam War. More than 2,300 US airmen were killed or listed as missing and presumed dead, while 325 were held as prisoners.

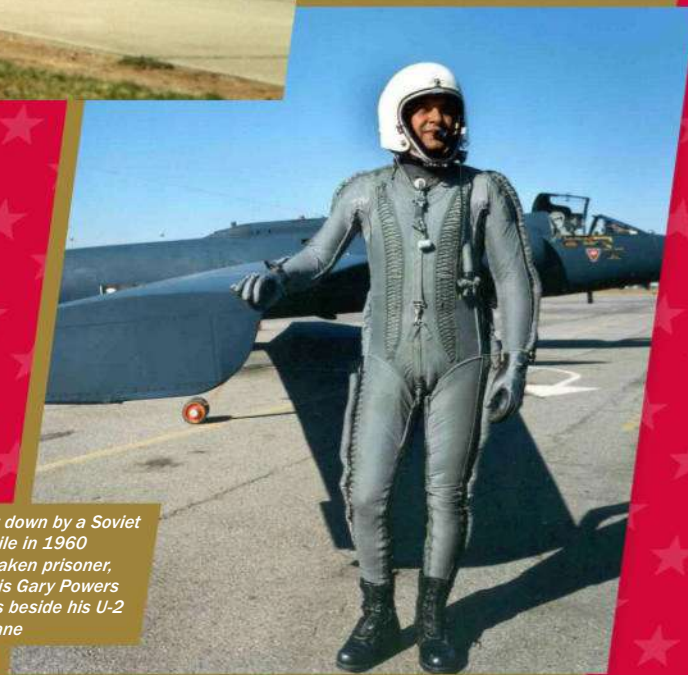
Throughout the Cold War, aerial surveillance was a key aspect of Air Force operations. To that end, high-flying reconnaissance aircraft such as the Lockheed U-2 and SR-71 Blackbird carried out sensitive missions. Although no SR-71 was lost to Soviet missiles, the shootdown of a U-2 piloted by Francis Gary Powers sparked an international incident in 1960. Overflights of Cuba also led to the dispute regarding Soviet medium-range ballistic missiles on the island during the Cuban Missile Crisis of 1962.

The Cold War continued to be a hotbed of air espionage operations until the collapse of the Soviet Union in 1991.

An F-86 Sabre fighter jets sits at an airfield in Korea. The Sabre was the primary Air Force fighter during duels with communist MIG fighters

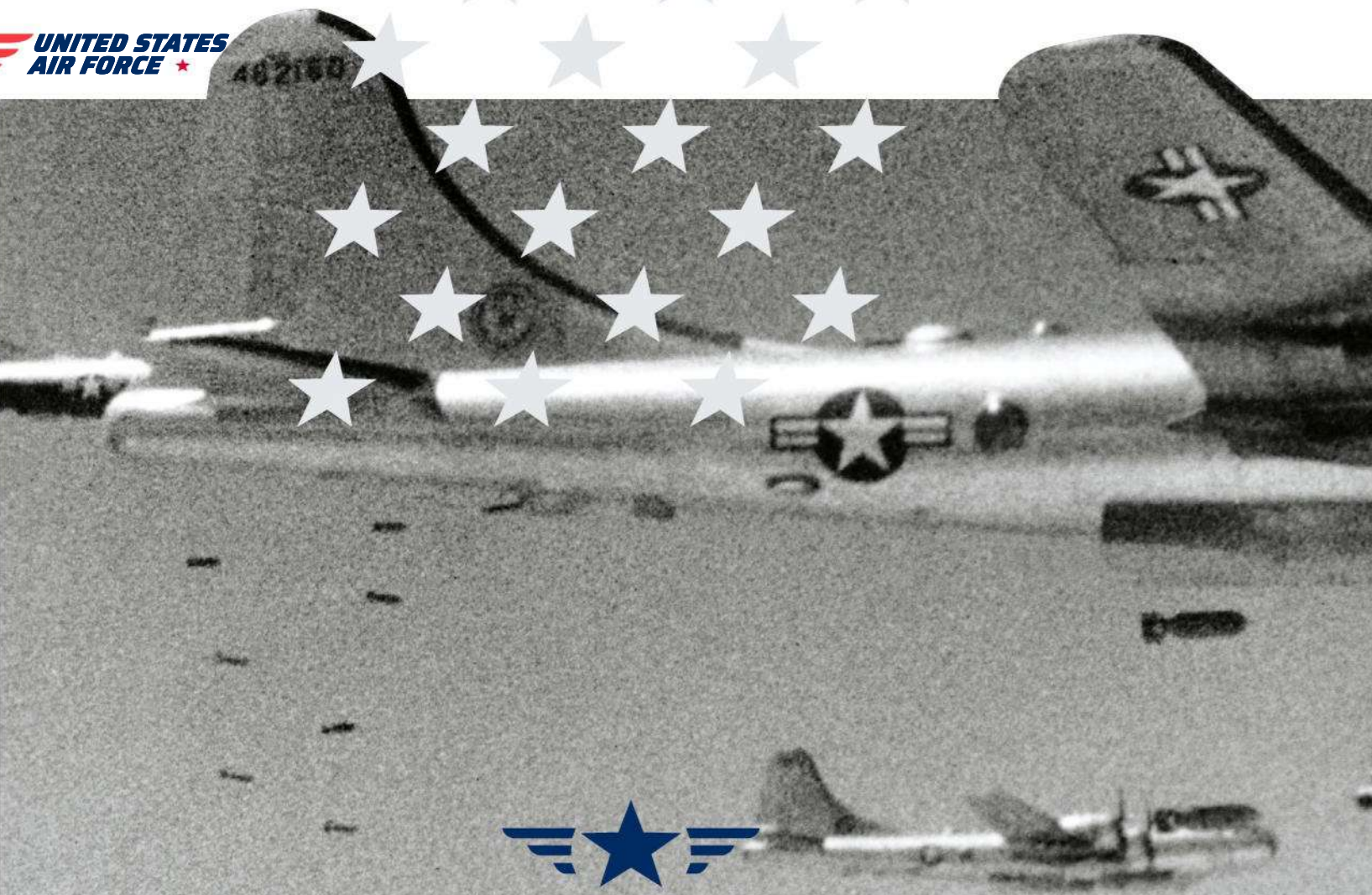


A trio of Air Force Republic F-105 Thunderchief fighter bombers takes off from an airfield in Southeast Asia to bomb targets in North Vietnam, 1966



Shot down by a Soviet missile in 1960 and taken prisoner, Francis Gary Powers stands beside his U-2 spy plane

Images: Wiki



BOMBING

The **HISTORIC BELLIGERENCE** of the North Korean regime is at least partly explained by memories of a savage and remorseless bombing campaign, where the use of **ATOMIC WEAPONS** was considered



When the regime of Kim Jong-un issued threats against the United States territory of Guam in 2017, few observers noted that the first B-29 bombers that bombed Korean targets took off from Andersen Air Force Base, Guam, just a few days after Kim's grandfather sent his armies into the south in June 1950.

North Korea was devastated by the US Air Force campaign. The head of the Strategic Air Command (SAC), General Curtis LeMay, claimed that American bombing killed 20 per cent of the North's population and left not a single village unscathed. Western media seldom reported the bombings: accounts of the air war focused on the high-altitude duels between Soviet-built MiG-15s and American F-86 jets in the so-called 'MiG Alley' near

the Chinese border. Yet on 29 August 1952 the North's capital Pyongyang endured over 1,400 sorties in one night alone.

Initially the Supreme Commander of UN forces General Douglas MacArthur was under instructions to limit targets north of the 38th parallel dividing the Koreas, lest the Chinese or Soviets step up their aid to the North. The first B-29s, accompanied by P-51 Mustangs and Lockheed P-80 jets, were barely threatened by the North's propeller-driven Yakovlev and Sturmovik planes or by ground fire. Flying from the Japanese bases of Yokota and Kadena, they escorted UN forces north towards the Yalu River before the Chinese intervention caused the Korean conflict to escalate further.

After 200,000 Chinese People's Liberation Army (PLA) troops intervened on the side of the North in October, the scale of the bombings was vastly increased and included the use of incendiary devices. B-29 bombers typically

carried 39,500-pound bomb loads with delayed action fuses and one magnesium flare designed to illuminate a target area for bombardiers bringing up the rear. Bombing missions by B-29s were augmented by Douglas B-26 Invaders flying at lower levels. As early as November, these missions had wreaked sufficient destruction for the North Korean leadership to instruct the population to build dug outs and underground schools. That same month MacArthur even sent two bomber groups, the 22nd and 92nd, back to the US. But by 1951 the US Air Force had largely run out of urban targets and turned to irrigation and hydroelectric dams. These bombings would inflict another kind of misery: flooding farmland and causing starvation among an already brutalised population. In June 1953 American aircraft bombed the irrigation dams of the North's Toksan Reservoir, flooding villages and farms. Similar actions by the Nazis

B-29 Superfortresses were capable of carrying large payloads and travelling huge distances. They could also be modified to carry atomic weapons

"AS THE PLA ADVANCED SOUTH, TRUMAN GAVE A PRESS CONFERENCE AND STATED THAT HIS ADMINISTRATION WOULD CONSIDER ANY STEPS NECESSARY TO WIN IN KOREA, INCLUDING THE USE OF ATOMIC WEAPONS"

THE NORTH

in the Netherlands in World War II had been considered a war crime.

For all the devastation wrought by conventional weaponry, the shadow of the atomic bomb loomed across the Korean battlefield. At the outset of the invasion, the United States had nearly 300 Mark-4 plutonium weapons in its stockpile, and while the Soviets had tested a similar weapon in 1949, it would be two years before they conducted a test drop. In July 1950 LeMay was ordered by President Harry Truman to move B-29s to England, to be capable of hitting Soviet targets. Weeks later the first of 20 nuclear-capable B-29s were sent to Guam. By November, as the PLA advanced south, Truman gave a press conference and stated that his administration would consider any steps necessary to win in Korea, including the use of atomic weapons.

In April 1951 he authorised nine devices to be transferred to atomic-capable B-29s at Kadena Base, Okinawa. Although the SAC set up a command and control centre in Tokyo, the aircraft were removed by June. Nevertheless, the 'Hudson Harbour' operations took place in October – 'dummy run' missions against potential targets.



By this time the war was largely stalemated on the ground, but it is uncertain if the atomic option would have changed the course of the war. Communist forces were widely dispersed and relied on a primitive infrastructure, and the destructive strength of the bombs available at the time was limited. But even without their use, the air war proved a calamity for Korea's

civilian population. Like the bombing of German and Japanese cities a few years earlier, a key objective was destroying the enemy population's morale. Ultimately the North Korean state survived. Memories of the merciless nature of the aerial campaign have, in part, guided its leaders ever since, endangering the region even today.



C-130 HERCULES

One of the longest-lasting and most widespread military transport vehicles of all time, the Hercules remains to this day an **AERIAL BEHEMOTH**, capable of flying thousands of miles to **DEPLOY TROOPS, VEHICLES AND MATERIEL**

★ WORDS: TIMOTHY WILLIAMSON ★

CREW

Five crew members are required to operate the C-130, including two pilots, a navigator, payload master and engineer. More recent iterations of the aircraft are capable of operating with a reduced crew, while vehicles designated for aeromedical missions are also crewed by trained medics.

POWERPLANT

Four Allison T56-A-15 turboprop engines provide a combined 18,360 shaft horsepower, while the most recent Super Hercules was upgraded with Rolls-Royce AE2100D3 engines, each with six-bladed composite propellers.



he C-130 Hercules is famed for its durability and versatility, and during its long service has established itself as the backbone of world militaries.

Since its introduction over 40 models and variants have been produced and are used today by more than 60 nations worldwide.

The need for a new heavy-lifting military transport first became a priority of the American military during the Korean War. Here,

troops and materiel needed to be transported, often landing on small, poorly maintained airstrips. Though Lockheed Martin began developing a prototype during the war, it would not take flight until 23 August 1954, from the company's California plant. Nonetheless the C-130 proved a success, capable of takeoff in just 800 feet, and shortly after the first orders were arriving at US Air Force bases. During the Vietnam War, C-130s used a Low Altitude Parachute Extraction System (LAPES)

to resupply troops at Khe Sanh, without the aircraft needing to land.

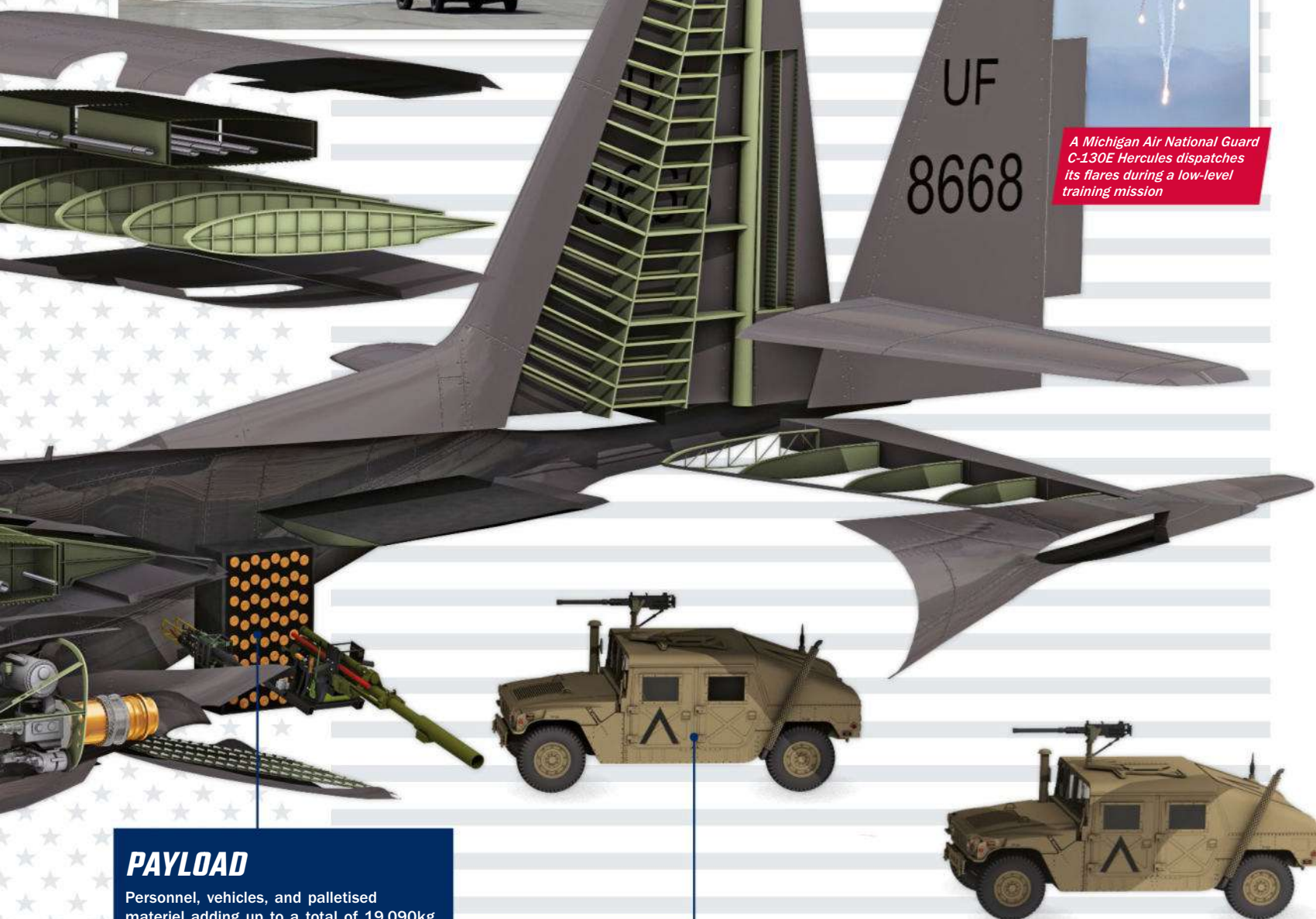
The aircraft is recognisable around the world by its cavernous central fuselage, in which the vast cargo bay can carry a huge number of personnel, vehicles, equipment, weapons and supplies over long distances. This has made the Hercules an ideal tool in military operations for decades, especially in 21st-century war zones where mission parameters often need to adapt fluidly and at high speed.



US Air Force
Lockheed C-130s



A Michigan Air National Guard
C-130E Hercules dispatches
its flares during a low-level
training mission



PAYLOAD

Personnel, vehicles, and palletised materiel adding up to a total of 19,090kg (42,000lbs) can be stowed in the cargo bay, and deployed via the roll-on roll-off loading ramp to the rear of the fuselage.

The sheer lifting power of the C-130 cannot be overstated, with a single plane capable of lifting northwards of 33,000 kilograms (72,753 pounds), including payload and its own weight. As a heavy-lifting workhorse, the C-130 has few competitors capable of matching it and, as such, has seen off several contenders that were supposed to replace it (such as the C-5 Galaxy) and is so useful and versatile it even spawned a larger but rarer Super Hercules variant, which first took flight in 1996.

**"THE SHEER LIFTING
POWER OF THE
C-130 CANNOT BE
OVERSTATED, WITH
A SINGLE PLANE
CAPABLE OF LIFTING
NORTHWARDS OF
33,000 KILOGRAMS"**

HERCULES C-130

COMMISSIONED:	1956
ORIGIN:	USA
RANGE:	3,800KM (2,360MI)
ENGINES:	ENGINE: 4 X ALLISON T56-A-15 TURBOPROP (3,423KW/4,590SHP)
CREW:	5
PRIMARY WEAPON:	2X MOUNTED M134 MINIGUNS



Ground crew remove an engine after a C-130 Hercules engine swap

POWERPLANT ★

Four Allison T56-A-15 turboprop engines are equipped to each C-130H, producing a huge 3,423kW (4,590shp) each. These enable the aircraft to reach a respectable top speed of 592km/h (366mph). The T56 is a single-shaft turboprop with a 14-stage axial flow compressor. The titanic turboprops enable the Hercules to climb at a rate of 9.3 metres (31 feet) per second, meaning it can quickly climb out of range of anti-aircraft armaments or other threats. The C-130 has a service ceiling of 10,000 metres (33,000 feet) with a cruise speed of 541 kilometres (336 miles) per hour.

Staff Sgt Christopher Rhodus performs an inspection on a C-130 Hercules engine



"THE TITANIC TURBOPROPS ENABLE THE HERCULES TO CLIMB AT A RATE OF 9.3 METRES (31 FEET) PER SECOND, MEANING IT CAN QUICKLY CLIMB OUT OF RANGE OF ANTI-AIRCRAFT ARMAMENTS"

A Royal Air Force Lockheed C-130J Hercules



AVIONICS ★

Later models in the H series of C-130s were installed with ring laser gyros, GPS receivers, an upgraded APN-241 colour weather and navigational radar, improved generator control and bus switching units as well as an integrated radar and missile warning system. A large amount of mission-specific equipment can be fitted and removed from the Hercules as required.

Images: Wiki



General Thomas
M. Ryan Jr. piloting a
Lockheed
C-130 Hercules

COCKPIT AND CREW ★

Due to its tremendous size and flexible capabilities, the C-130H is manned by five crew members, including two pilots, a navigator, flight engineer and load master. Due to the plane's large carrying capacity, the load master's role is to determine how to most efficiently load huge and diverse cargo. The latest C-130J Super Hercules iteration is designed to be operable with only two pilots and a payload master, in order to minimise risk.



PAYLOAD ★

With a maximum carrying weight of 19,090kg (42,000lbs), the C-130H can transport 92 combat troops or 64 airborne troops, three Humvees or two M113 armoured personnel carriers. If kitted out for a medical evacuation role, a single C-130H can also carry 72 litter patients plus two medics. Including its full weight, the Hercules engines are able to lift more than 33,000 kilograms (72,753 pounds) at high altitude.

US Army
Paratroopers
prepare to board a
US Air Force
C-130 Hercules

US Air Force Airmen from the 720th Special Tactics Group jump out of a C-130J Hercules during water rescue training in Florida



"SINCE ITS DEBUT, THE C-130 HAS SERVED AS THE WORKHORSE IN NEARLY EVERY MAJOR CONFLICT, FROM THE KOSOVO WAR, TO THE AFGHANISTAN INSURGENCY"

SERVICE HISTORY ★

C-130s have served with military forces around the world for over 60 years, fulfilling many operational roles including reconnaissance, special operations, combat delivery, humanitarian missions and more. During the Cold War, ski-fitted C-130s were used to resupply Distant Early Warning Line sites located in the Arctic Circle and many are also still in service with civilian coast guards for search and rescue support.

Since its debut, the C-130 has served as the workhorse in nearly every major conflict, from the Kosovo War, to the Afghanistan insurgency. In 2017, a specially adapted C-130 dropped a GBU-43/B Massive Ordnance Air Blast, or 'Mother of All Bombs' on target in Eastern Afghanistan.

In December 2011, Lockheed Martin announced two new variants of the Hercules: the C-130XJ and C-130NG. As such, despite the

aircraft's age, it is unlikely that it will be retiring any time soon. The Super Hercules iteration is in operation across more than 20 countries and has clocked over two million hours of flight time. While some nations are replacing their Hercules fleet, the US Air Force is instead focusing on upgrading its existing C-130 aircraft while using C-17 Globemasters and C-27J Spartans too.

A US Air Force Lockheed LC-130H-LM Hercules at Williams Field, Antarctica





BOEING B-52 STRATOFORTRESS

This iconic symbol of **AMERICAN AIR POWER** is one of the oldest military aircraft in service today, and still a **POTENT FORCE** to be reckoned with



The B-52 Stratofortress defines the era for which it was created: the Cold War. At a time when nuclear war threatened to destroy humanity, this aircraft acted as both the enabler of apocalyptic destruction and its deterrent. It is the ultimate heavy bomber, designed for sorties from a maximum height of 50,000 feet, primarily with nuclear weapons.

The craft has a total global reach, as it can be refuelled in midair, but what is most surprising is its age and flexibility. Although it is still one of the most feared weapons in the USA's arsenal, the first prototypes were ordered as far back as 1948, in the wake of WWII, with the first plane taking to the skies in April 1952.

The key to the B-52's success is its relative simplicity. Despite a huge airframe, it is not made from complex materials like carbon fibre, and as such it can adapt to many different modifications and parts can be easily repaired or replaced. The specific aircraft featured here was ordered in 1956 and first flew in 1957, becoming the 689th B-52 to enter service. It now resides in the American Air Museum as part of the Imperial War Museum Duxford in Cambridgeshire, UK.

Over 700 of the planes have been built and any B-52s that are in service today were built in the early 1960s. Engineering analyses have shown that the B-52's operational lifespan could extend beyond 2040, an extraordinary achievement for an aircraft design that predates the Korean War.

"ALTHOUGH IT IS STILL ONE OF THE MOST FEARED WEAPONS IN THE USA'S ARSENAL, THE FIRST PROTOTYPES WERE ORDERED AS FAR BACK AS 1948, IN THE WAKE OF WWII, WITH THE FIRST PLANE TAKING TO THE SKIES IN APRIL 1952"

BOEING B-52 STRATOFORTRESS

POWER PLANT: 8 PRATT & WITNEY ENGINES TF33-P-3/103 TURBOFAN

THRUST: EACH ENGINE UP TO 17,000 LBS

WINGSPAN: 56.4 M (185 FT)

WEIGHT: APPROX 83,250 KG (185,000 LBS)

FUEL CAPACITY: 14,1610 KG (312,197 LBS)

SPEED: 650 MPH (MACH 0.86)

RANGE: 8,800 MI (7,652 NAUTICAL MILES)

CEILING: 15,150 M (50,000 FT)

CREW: 5 (COMMANDER, PILOT, RADAR NAVIGATOR, NAVIGATOR, ELECTRONIC WARFARE OFFICER)

ARMAMENT: APPROX 31,500 KG (70,000 LBS) MIXED

ORDNANCE: BOMBS, SMART WEAPONS, MINES AND MISSILES. MODIFIED TO CARRY AIR-LAUNCHED CRUISE MISSILES AND MINIATURE AIR LAUNCHED DECOY

“ENGINEERING ANALYSES HAVE SHOWN THAT THE B-52’S OPERATIONAL LIFESPAN COULD EXTEND BEYOND 2040, AN EXTRAORDINARY ACHIEVEMENT FOR AN AIRCRAFT DESIGN THAT PREDATES THE KOREAN WAR”

The B-52 is still an active part of the US nuclear triad along with submarines and ballistic missiles

A B-52H refuels over Afghanistan. Airborne refuelling gives the B-52 an almost limitless global reach. It will only land if there are oil or engine problems

Crews of the B-52 would adorn their aircraft with symbols of achievements such as the number of missions flown

ARMAMENT ★

B-52s were originally designed to exclusively carry nuclear bombs, which was seen as the primary role. However, the plane can also carry 12 Advanced Cruise Missiles, 20 Air Launched Cruise Missiles or eight standard nuclear bombs. It was not until the F Model that a modification was made to carry additional weapons. A 'Big Belly' modification can pack in a 500-pound bomb along with additional explosives on the wings totalling a weight of 60,000 pounds. This figure needs to be tripled as B-52s always travel in groups of three, usually flying at 40,000 feet to avoid detection.

"THE PLANE IS CAPABLE OF CARRYING 12 ADVANCED CRUISE MISSILES, 20 AIR LAUNCHED CRUISE MISSILES OR EIGHT NUCLEAR BOMBS"



Nuclear destruction was available literally at the flick of a button in the B-52



An AGM-129 ACM. It was the US Air Force's most advanced air-launched nuclear missile until it was decommissioned in 2012

A B-52H displaying the variety of weapons it is capable of carrying, from cluster bombs to harpoons



The 'Special Weapons' on a B-52 are a grim collection of destructive power

The 'Special Weapons' (centre top) are controlled from the navigation suite under the cockpit

SPECIAL WEAPONS ★

In addition to a capacity for carrying nuclear weapons, a current 'H' Model B-52 is also capable of carrying a myriad of other explosives. Its arsenal can include 51 unguided bombs, 42 cluster bombs, ten laser-guided bombs, 51 mines and even eight guided harpoons to be used against ships. Perhaps most notoriously, B-52s dropped napalm bombs and incendiaries as a defoliant during the Vietnam War. A single bomb could destroy areas up to 2,500 square yards and the bombers were largely responsible for dropping 8 million tonnes of napalm over Vietnam between 1965-73.

Napalm bombs explode on Vietcong structures. Many B-52s were involved in dropping millions of tonnes of napalm during the Vietnam War



A periscope above the Browning .50 machine guns assisted the rear gunner

REAR GUNNER ★

Up until the First Gulf War, every B-52 was manned by a rear gunner who remotely operated four rear-facing Browning .50 machine guns or a M61 Vulcan cannon. The gunner was capable of seeing a considerable distance with the use of a periscope. It was a tough, lonely job, as the aircraft could be airborne for over 24 hours. Unlike his colleagues in the front of the plane, there was no place for the gunner to lie down and sleep. The only way the other crew members could communicate with the gunner was via an interphone. The turbulence could be so bad in the rear, that gunners often suffered from concussion.

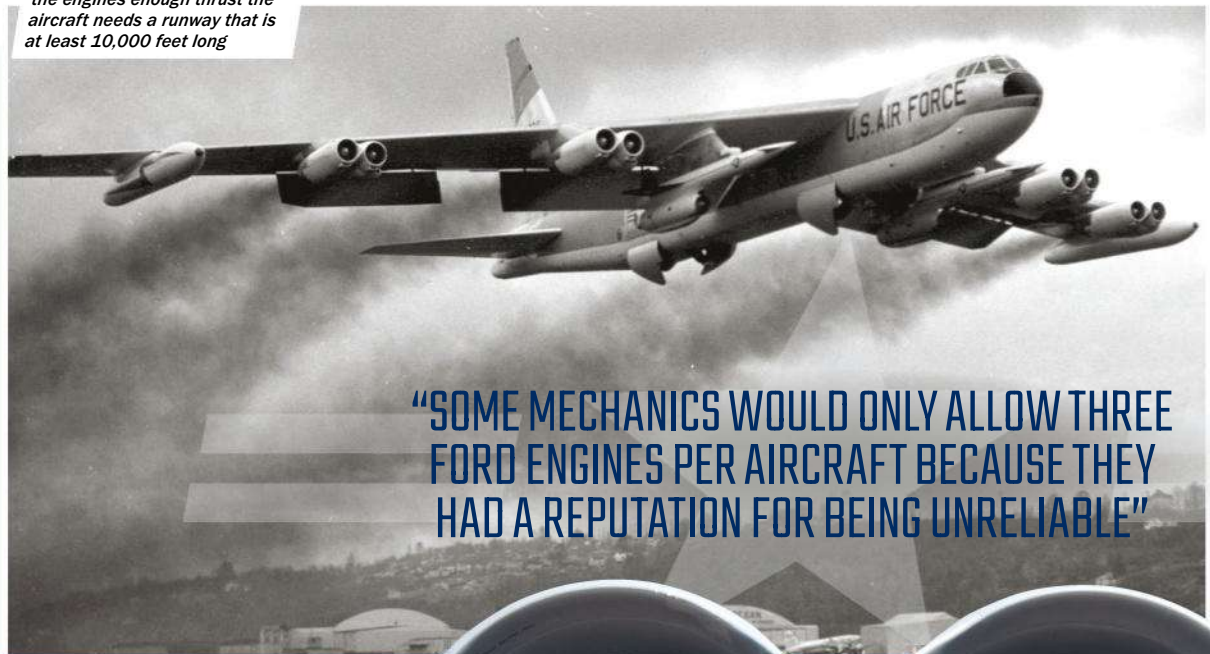
The instrumental panel of the B-52 has changed little since the 1950s

Dials include readings for pressure, speed, fuel flow, altitude and bearings

COCKPIT ★

This cockpit dates from 1957 but modern B-52s look almost the same. The only difference between then and now is the use of infrared cameras and low-light televisions. The instrument panel works from the top down. At the top are readings of oil pressure for each engine. In the centre are dials for measuring the percentage of the plane's revolutions per minute (rpm) – a B-52 operates at an average of 160,000 rpm. Below this is the exhaust gas temperature, a thermal coupling that measures how hot the air in the plane's rear is. Finally, at the bottom are the readings for fuel flow, which in a B-52 can measure 1,500 pounds per hour.

A B-52H taking off. To give the engines enough thrust the aircraft needs a runway that is at least 10,000 feet long



"SOME MECHANICS WOULD ONLY ALLOW THREE FORD ENGINES PER AIRCRAFT BECAUSE THEY HAD A REPUTATION FOR BEING UNRELIABLE"

POWERPLANT ★

B-52s were produced on a wartime footing and sometimes employed unconventional contractors to build the engines. For instance, Ford Motor Company made this plane's engines. Ford produced numerous plants for the B-52 but many in the Air Force disliked them. Some mechanics would only allow three Ford engines per aircraft because they had a reputation for being unreliable. Pratt & Whitney engines now power modern B-52s.

B-52s have eight engines, providing 136,000 lbs of thrust to get 450,000 lbs of aircraft off the ground



American air museum Restoration project

The Imperial War Museum Duxford has undertaken a major restoration project to preserve over a century's worth of American military aircraft. Section Head, Chris Knapp tells us more

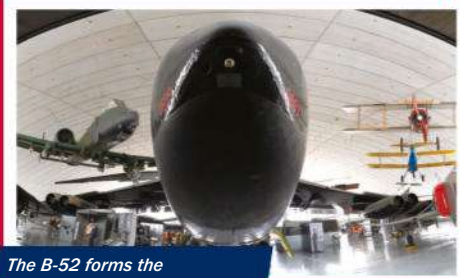
"The driving force for the project initially was that a lot of these aircraft had been suspended for 17 years and whilst we can inspect the suspensions manually, which we do, we cannot open up the aircraft to inspect the airframe itself. It's still a mechanical object, even though it's a museum piece, and some of them are over 100 years old so we had to get them all down to inspect them. We couldn't find any information anywhere of other museums that had taken aircraft down and inspected them.

"My colleagues in Exhibitions and Displays said that they would re-configure the whole setup and redo everything with new displays. The glass wall had to come down and we had five weeks to get everything out, three months to inspect everything and then five weeks to get it back in. The F-111 and the A-10 were in

the original paint that they flew in when they arrived here so we would do a lot to preserve that. The B-52 stood outside for a long time when it first came. The paint had deteriorated so we had to remove it, do some repairs to the corrosion and repaint it. We're careful on whatever we're working with.

"Every project has to stand or fall on its own merit but our primary aim is to preserve the history as much as possible. An object soaks up history; if you handle it you will lose history, the more you handle it the more history you lose. We're in the business of preserving history. A highlight is definitely the B-52. I can tell you the theory of flight but it still amazes me that it gets in the air. In the museum as a whole I have a soft spot for the Westland Wessex and the Sea King because I worked on both of those in service."

IWM DUXFORD



The B-52 forms the centrepiece of the museum



IWM Duxford has a wide array of American military aircraft



MAD DAWN

How technology transformed **STRATEGIC THINKING** and **MILITARY DOCTRINE** from the Cold War to the current day

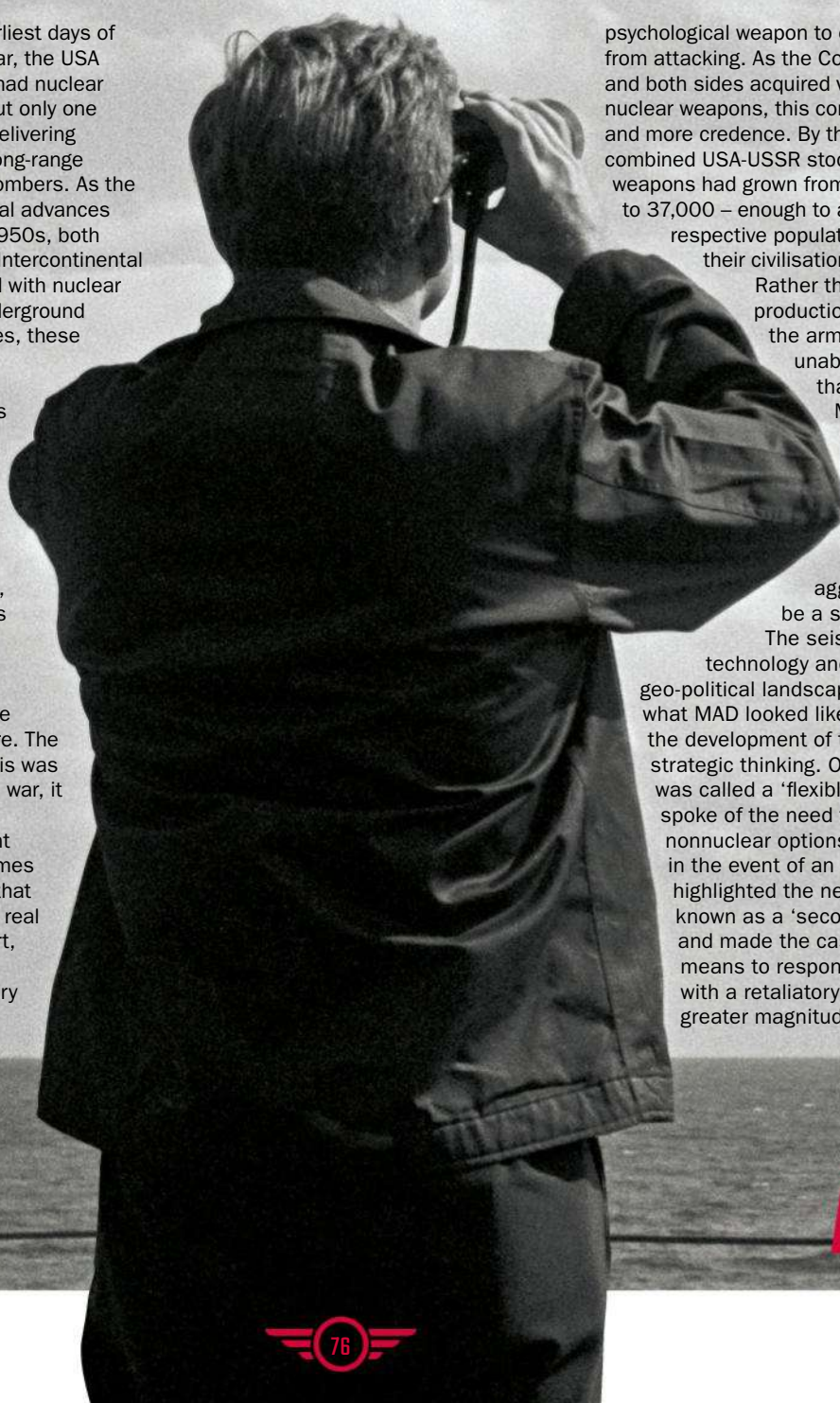


From the earliest days of the Cold War, the USA and USSR had nuclear weapons but only one means of delivering a strike – long-range strategic bombers. As the conflict progressed, technological advances changed that. Throughout the 1950s, both superpowers began developing Intercontinental Ballistic Missiles (ICBMs) armed with nuclear warheads which they stored underground in protective silos. In some cases, these missiles had several warheads and were known as Multiple Independent Re-Entrant Vehicles (MIRVs). In addition, both sides also developed Submarine Launched Ballistic Missiles (SLBM) that were harder to track and target because they operated beneath the oceans' surface. Between them, the bombers, ICBMs and SLBMs formed what came to be known as the nuclear triad: a joined-up, combined-forces land, sea and air strategy that mirrored the approach to conventional warfare. The difference, however, was that this was not a strategy designed to win a war, it was designed to prevent one.

The idea of a military deterrent can be traced back to Roman times but it wasn't until the Cold War that nuclear weapons unleashed the real potential of this idea. At its heart, it had always proposed that the threat of an overwhelming military response could be used as a

psychological weapon to dissuade an enemy from attacking. As the Cold War progressed and both sides acquired vast arsenals of nuclear weapons, this concept gained more and more credence. By the mid-1960s, the combined USA-USSR stockpile of nuclear weapons had grown from 3,000 in 1955 to 37,000 – enough to annihilate their respective populations and eradicate their civilisations several times over. Rather than call a halt to the production of nuclear weapons the arms race continued unabated amid a doctrine that was named Mutually Assured Destruction – or MAD. It effectively terrorised each side into keeping the peace, knowing that an act of aggression would also be a suicidal one.

The seismic shifts in technology and the evolving geo-political landscape helped to define what MAD looked like. This resulted in the development of two distinct lines of strategic thinking. One argued for what was called a 'flexible response' and spoke of the need for nonmilitary and nonnuclear options to be considered in the event of an attack. The other highlighted the need for what was known as a 'second strike capability' and made the case for having the means to respond to a nuclear attack with a retaliatory attack of similar or greater magnitude.



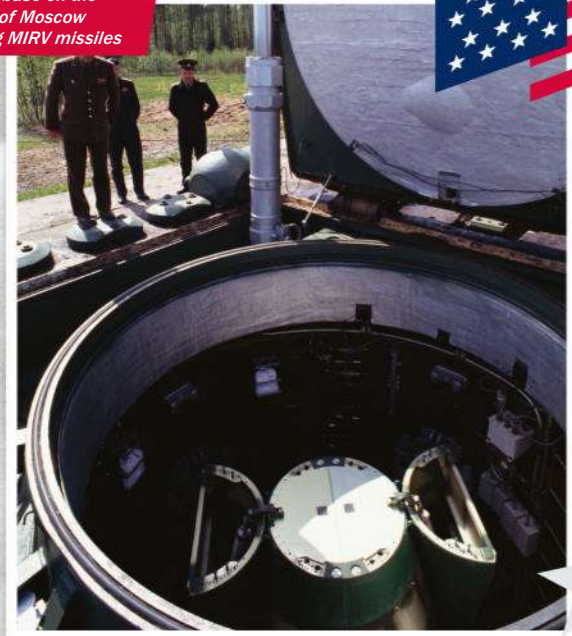
*President Kennedy
observes the launch
of a Polaris missile*

By the early 1960s, US intelligence was claiming, wrongly as it turned out, that the Soviets had enough ICBMs to wipe out all of America's retaliatory capability before a second strike could be launched. In keeping with the kind of warped logic that had given the world MAD, the US military now came up with an outlandish solution to this perceived 'missile gap', as it was called.

Operation Chrome Dome was a United States Air Force (USAF) mission that lasted from 1961 to 1968. It saw a never-ending convoy of B-52 bombers armed with nuclear warheads fly in constant rotation just outside Soviet airspace, 24 hours a day, seven days a week. At any given time, there were up to 50 fully armed B-52s in the air, guaranteeing a second strike capability even if a Soviet attack destroyed all US airfields and missile sites. Sorties typically lasted 24 hours, with planes being refuelled in mid-air, and often took the bombers, and their bombs, over large tracts of the US, Canada and Greenland. With so many sorties being flown, accidents were inevitable. In total, there were five crashes involving thermonuclear devices, including the infamous Goldsboro crash in 1961. The operation was eventually closed down in 1968 after a B-52 crashed into sea ice in North Star Bay, Greenland. The nuclear payload ruptured in the subsequent explosion, causing radioactive contamination of the entire area.

Despite several international treaties that sought to curtail the proliferation of nuclear weapons, there were an estimated 70,000 in existence by the time the Cold War ended in 1991. Today, that number has dropped to around 12,000, although ownership of them has spread. In addition to the US and Russia, the UK, France, China, Israel, India, Pakistan and North Korea all have nuclear weapons. As a result, deterrence still plays a vital part in global security and international relations. But its role has become more complex as each of

Soviet personnel inspect a missile base on the outskirts of Moscow containing MIRV missiles



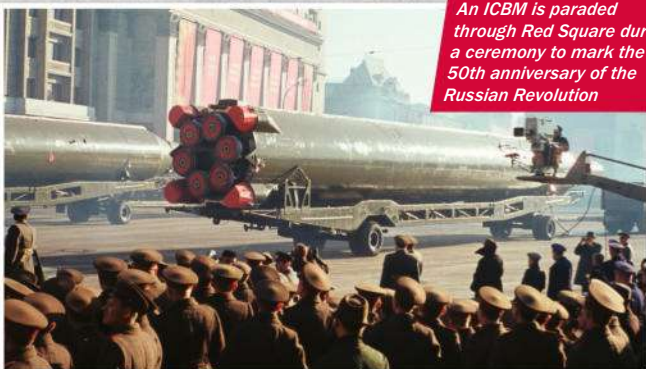
**“MUTUALLY ASSURED
DESTRUCTION EFFECTIVELY
TERRORISED EACH SIDE
INTO KEEPING THE PEACE,
KNOWING THAT AN ACT OF
AGGRESSION WOULD ALSO
BE A SUICIDAL ONE”**

those countries has its own set of deterrent relationships with the nations that it views as adversaries.

There are also many other countries, such as Japan, South Korea and the growing list of NATO states that are closely allied to the US and therefore enjoy what's called extended deterrence status. In other words, their security is underwritten by the US nuclear capability. The US is the only nuclear power to do this, leveraging its nuclear arsenal both militarily and diplomatically to extend and maintain its global dominance.

The world has lived with the threat of nuclear Armageddon for decades now. The fact that humanity has so far avoided it appears to be more a matter of luck than judgement.

An ICBM is paraded through Red Square during a ceremony to mark the 50th anniversary of the Russian Revolution



The US Air Force Ryan AQM-34L Firebee drone Tom Cat of the 556th Reconnaissance Squadron flew 68 missions over North Vietnam before being shot down by anti-aircraft fire over Hanoi



THE LIGHTNING

The Cold War's hotter episodes in Southeast Asia became a proving ground for **CUTTING-EDGE DRONE TECH**



In the Cold War the development of unmanned or uninhabited aircraft leapt into the space age. The US Air Force, awash in R&D funding and supported by the

world's largest aerospace industry, steered multiple programmes that turned remotely piloted aircraft models from clumsy devices to supersonic marvels, among other achievements. Luckily, rather than even the odds against the Soviets and their Warsaw Pact allies in Central Europe, events in Southeast Asia reached a point where the US military had to step in. The Gulf of Tonkin incident on 2 August 1964 triggered an immediate response from the Lyndon B Johnson administration, culminating in a vow to defend the Republic of Vietnam and humble its aggressive neighbour across the 17th parallel.

By 1964 the US Air Force maintained an intimidating posture in the Asia-Pacific region with a network of immense air bases stretching from Subic Bay to the California desert. The looming arrival of American forces in South Vietnam required a re-assessment of their foe North Vietnam, whose allies were equipping it with state-of-the-art weaponry. This accelerated the production and employment of the Ryan Model 147 drone.

The 147 was nicknamed the Lightning Bug in a nod to the historic Kettering Bug of 1918, and was classified as an asset for conducting intelligence, surveillance and reconnaissance (ISR). Although its appearance was odd, like a dart with a swollen belly that housed its turbojet engine, its tactical use was astounding. The first mission assigned to the Lightning Bugs was to bait and compromise the dreaded S-75 surface-to-air missiles of the North Vietnamese air defence network.

These SAMs, given the NATO designation SA-2 Guideline, gained notoriety when they took down a U2 spy plane over the Soviet Union, with its pilot Captain Gary Powers subsequently taken prisoner. Other U2 spy planes were lost in undisclosed circumstances over southern China and Cuba.

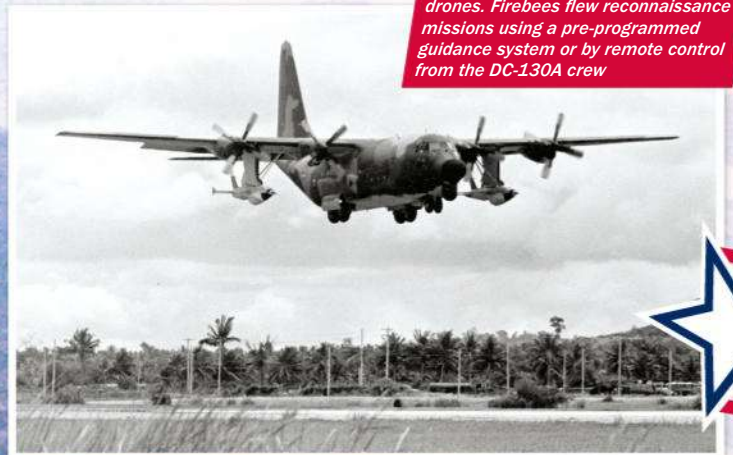
Deploying Lightning Bugs was a complicated affair; owing to their design they never 'took off' in the conventional sense. Each Lightning Bug, whatever the variant, was loaded under the wings of a C-130 Hercules medium transport, which would deploy the Lightning Bug outside its target area. Once in flight, the C-130 launched the drones as far as 1,000km from their objective. It is a testament to American innovation how successful the majority of Lightning Bug missions were, with 3,500 sorties flown between 1965 and 1973, with the same model updated into 30 different variants depending on the mission.

**"ALTHOUGH ITS APPEARANCE WAS ODD, LIKE A DART
WITH A SWOLLEN BELLY THAT HOUSED ITS TURBOJET
ENGINE, ITS TACTICAL USE WAS ASTOUNDING"**

*Engineers work on a
Ryan target drone. The
type could be configured
into 30 different variants
depending on the mission*



*A USAF DC-130A Hercules taking
off on a mission in Southeast Asia,
carrying two Ryan AQM-34 Firebee
drones. Firebees flew reconnaissance
missions using a pre-programmed
guidance system or by remote control
from the DC-130A crew*



BUG STRIKES!

When the Lightning Bug entered North Vietnam it tagged and collected data on SA-2 launches – vital for saving American pilots. Beyond this role the Lightning Bugs took photographs as part of battle damage assessments, searched for evidence of American POWs and performed electronic intelligence on the sophisticated Soviet-made radars the North Vietnamese operated.

The Lightning Bugs did fail on occasion – despite their aerodynamics they were subsonic aircraft with limited manoeuvrability. Many were shot out of the sky, although the numbers lost are out of the public domain, and a few crashes were collected by the North Vietnamese. The proper extraction of a Lightning Bug instead of letting them return to base (usually in Taiwan) required expertise and precise teamwork. Since allowing it to land via parachute often damaged the airframe the drones were modified with a harness so that a

large helicopter such as the CH-53 could pick it up on its way home.

Unfortunately, aerial losses over Vietnam were still catastrophic. Hundreds of the US Air Force's prized F-4 Phantoms were lost and the US Navy's carrier-based jet fighters in particular suffered scores of downings over several years. North Vietnamese SAMs managed to destroy at least 17 B-52H Stratofortress bombers and claimed a hefty percentage of the approximately 2,500 fixed-wing American combat aircraft that were lost from 1962 until 1973.

Thousands of Lightning Bugs were decommissioned in 1979 as the American military shook off its Vietnam syndrome and retooled itself to overcome the Soviets. The doctrine and ideation of how UAVs are employed in military operations changed as well. An interesting trend is that beyond the USA other countries maintained thriving drone programmes for the same reasons,

originally as training resources and then for intelligence gathering and electronic warfare. The Soviets were no different and the state-owned manufacturer Lavochkin developed its own version of the Ryan Model 147 called the La-17. (Ironically Lavochkin was also responsible for assembling the lethal SA-2 missiles the Lightning Bugs were designed to foil.) The other 'design bureaus' of the Soviet aircraft manufacturing sector like Mikoyan-Gurevich, Sukhoi, Tupolev and Yakovlev competed with each other with ever-more sophisticated drones. What the two great rivals of the Cold War seem to have missed in their separate drone programmes is that maybe propeller engines were a more economical choice for these aircraft types. The race is still on, however, as the renewed 'great power competition' involving China, Russia and the USA revive their enthusiasm for pushing the boundaries of unmanned systems.



MCDONNELL DOUGLAS F-4C PHANTOM

The legendary US jet was renowned for its **DEADLY VERSATILITY**

★ WORDS: STUART HADAWAY ★



The McDonnell Douglas F-4 Phantom is a true classic and one of the greatest warplanes ever designed. Work began in 1953 and the first prototype flew in 1958 – today the type is still in service with several air forces around the world. It was the United States' first all-weather, multi-role, missile-armed aircraft.

The Phantom has proven capable of excellent service as an air-superiority fighter, ground-attack aircraft, reconnaissance platform and at the Suppression of Enemy Air Defences (SEAD), most famously as the legendary 'Wild Weasel'. During the Vietnam War the Phantom led the way in multiple roles, including as a dogfighter and in beyond-visual-range (BVR) engagements with

the first generations of air-to-air guided missiles. Phantoms shot down over 150 North Vietnamese aircraft while serving with the US Air Force (USAF), US Navy (USN) and the US Marine Corps (USMC). All five American aircrew who hold the heroic and difficult to achieve 'ace' status, given for shooting down five or more enemy aircraft, did so in Phantoms.

"PHANTOMS SHOT DOWN OVER
150 NORTH VIETNAMESE AIRCRAFT
WHILE SERVING WITH THE US AIR FORCE"

FUEL STORAGE

The low-set engines allowed six fuel bladders in the fuselage, augmented by one in each wing root and, if needed, external tanks on the centreline pylon and both wings.

EXTRAORDINARY NOSE

Much of the Phantom's multi-role flexibility was due to the nose, which could easily be replaced to create reconnaissance versions, update radars and avionics, and later add an internal cannon.

FULL WEAPONS LOAD

The nine hard-points under the wings and centreline allowed for a staggering number and variety of weaponry to be carried, from cannon-pods to tactical nuclear bombs, as well as external fuel tanks.





An F-4C dives into an attack over Vietnam, 1967

Originally intended as a naval aircraft, in 1962 a drive by the US Department of Defense to standardise equipment led to the type being adopted across their armed forces. The F-4B entered service in the USN and USMC, and the F-4C with the USAF. The Phantom would eventually serve in over a dozen air forces around the world, and is still in service in Turkey, Greece and Iran.



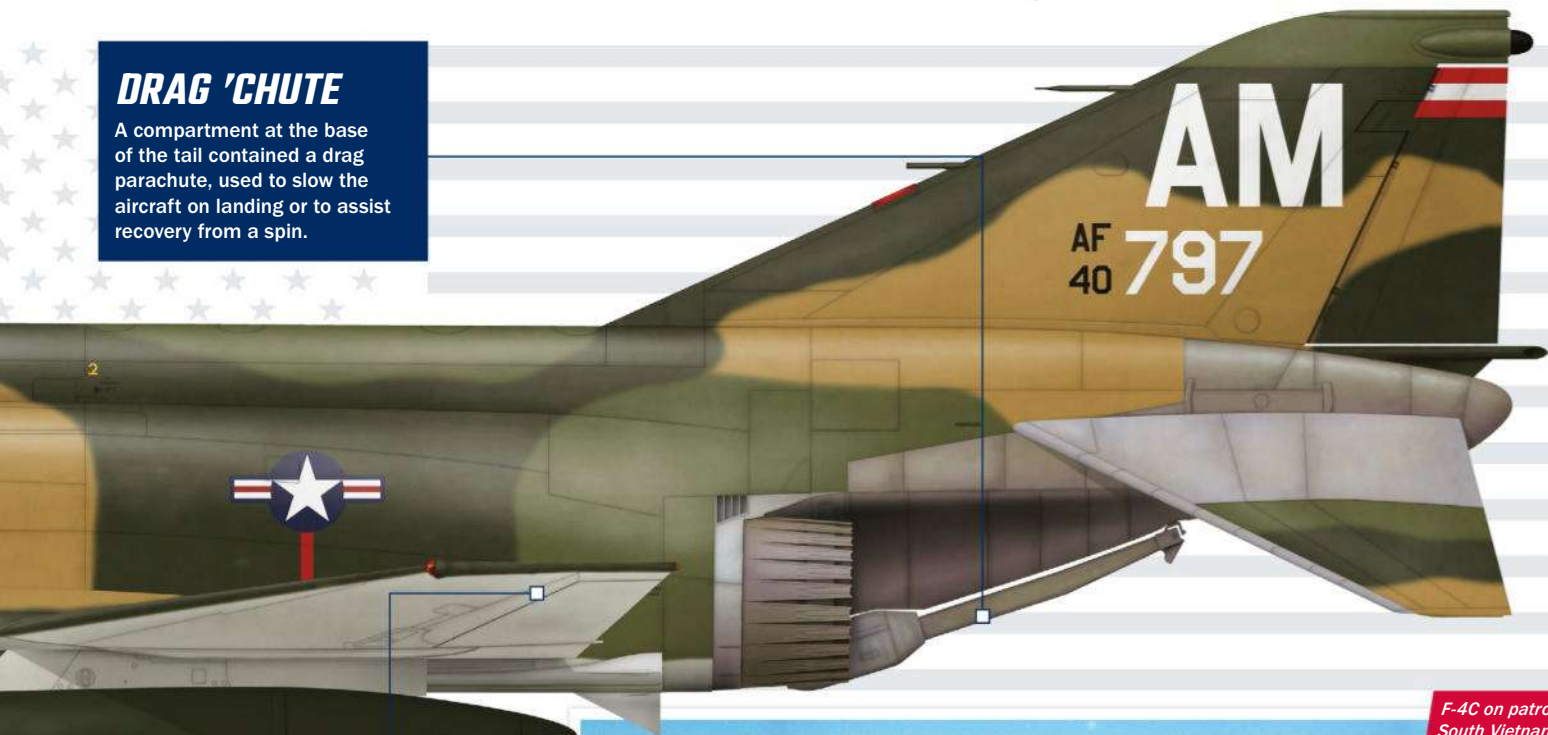
The USAF F-4C Phantom entered service in 1964

MCDONNELL DOUGLAS F-4C

COMMISSIONED	1955
ORIGIN	USA
LENGTH	62FT 11IN (19.17M)
WINGSPAN	38FT 5IN (11.71M)
RANGE	1,750 MILES (2,815KM)
SPEED	1,459MPH (2,348KM/H)
ENGINE	2X GENERAL ELECTRIC J79-GE-15 10,900LB (4,944KG) DRY-THRUST / 17,000LB (7,711KG) AFTERBURNER
CREW	2
PRIMARY WEAPON	UP TO 18,650LB (8,460KG) OF AIR-DROPPED OR AIR-LAUNCHED ORDNANCE, OR AN M61-A1 GUN PACK

DRAG 'CHUTE

A compartment at the base of the tail contained a drag parachute, used to slow the aircraft on landing or to assist recovery from a spin.



FOLDING WINGTIPS

The end sections of the F-4C's wings folded upwards, a legacy of the original USN design intended to save space in tightly packed aircraft carriers.



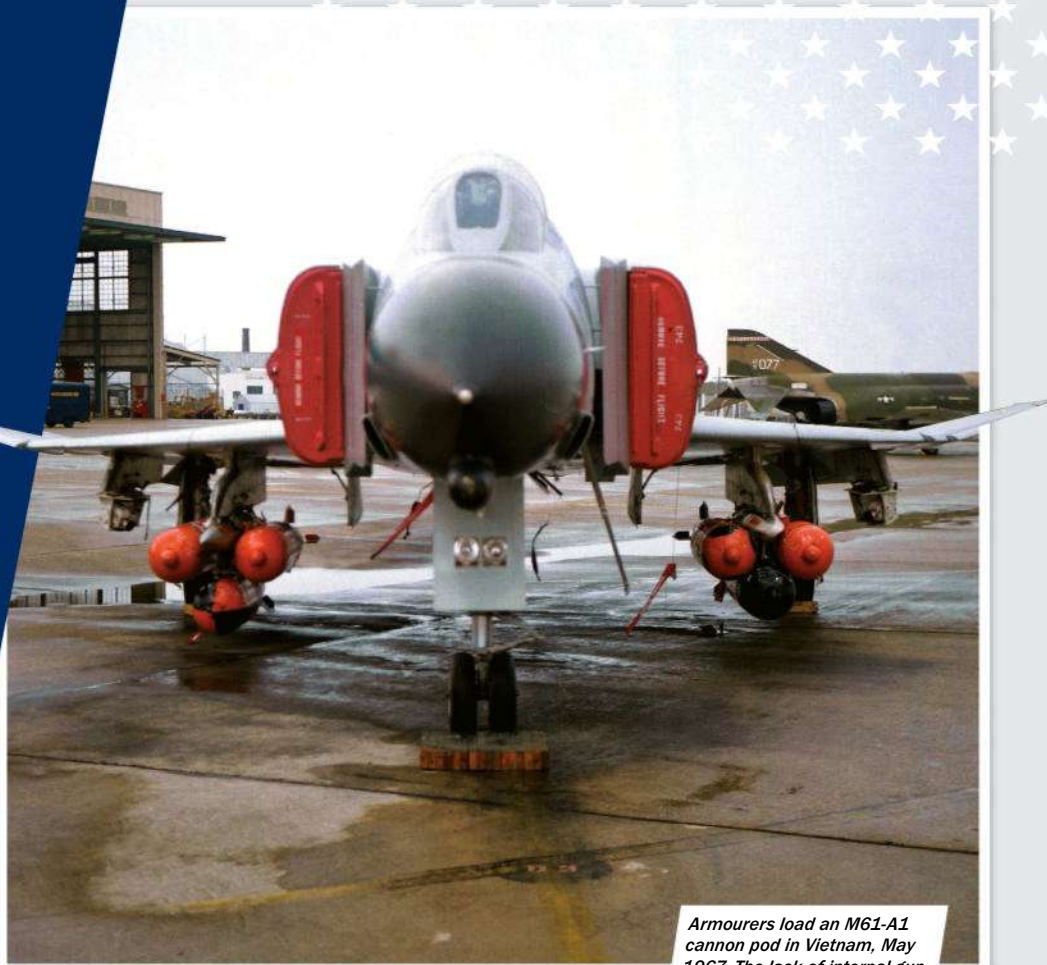
F-4C on patrol over South Vietnam

*A formation of F-4C
Phantoms drop their
bombs over North
Vietnam, August 1966*

**"THE F-4C SHOT DOWN
40 ENEMY AIRCRAFT DURING
THE VIETNAM WAR"**

ARMAMENT ★

The F-4C had nine external hard points which could carry a combined 18,650lb (8,460kg) of ordnance – twice that of a Boeing B-17 Flying Fortress. Missiles included a range of early air-to-air guided missiles such as the AIM-7D/E Sparrow and AIM-9B/D Sidewinder, as well as air-to-ground missiles including the AGM-12 Bullpup and AGM-65 Mavericks. The F-4C could also carry the AGM-45 Shrike anti-radiation missile, used for destroying enemy radars. Designed without an internal gun, combat experience over Vietnam led to external M61-A1 0.8in (20mm) gun packs being fitted. The F-4C shot down 40 enemy aircraft during the Vietnam War – 36 with missiles and four with cannon fire.



*Armourers load an M61-A1
cannon pod in Vietnam, May
1967. The lack of internal gun
was a weakness in the F-4C*

The Phantom's tail was designed to give clearance for the powerful engines' exhausts



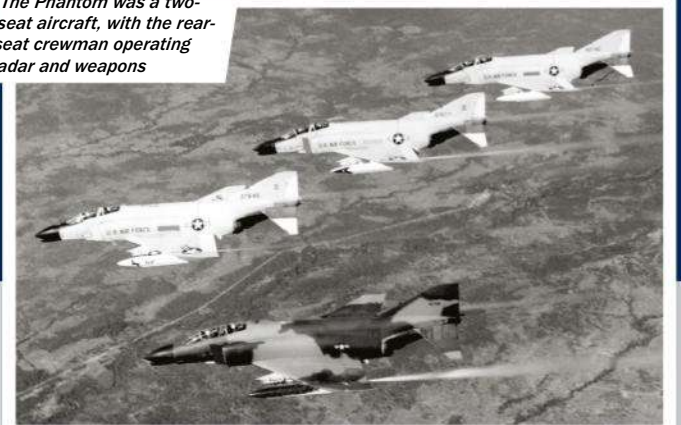
DESIGN ★

The Phantom was originally designed for naval operations, flying from aircraft carriers. Its undercarriage was robust and the nose wheel extended to improve lift during catapult launches. The wings were foldable to improve storage, with fuel tanks in the wing-roots (which suffered leakage problems in early models). The aircraft was optimised for high speeds, exceeding Mach 2, and dog-tooths and other modifications were added to the leading edge of the wings to improve control at high-angles of attack. The distinctive design of the tailplanes improved control while also keeping the control surfaces clear of the jet exhausts.

An RF-4C reconnaissance aircraft.
The F-4's solid, versatile design
allowed for several specialist variants



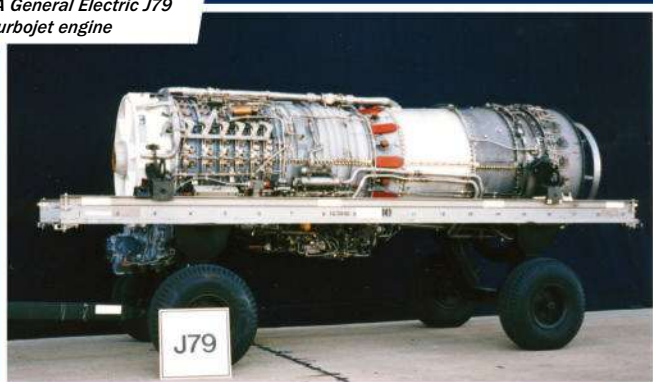
The Phantom was a two-seat aircraft, with the rear-seat crewman operating radar and weapons



ENGINE ★

Most Phantoms used variants of the General Electric J79-GE axial-flow turbojets. The two engines sat side-by-side and low in the fuselage, maximising space for internal fuel storage, with air being fed through fixed-geometry intakes. The J79-GE-15s used by the F-4C produced 10,900lb (4,944kg) dry thrust or 17,000lb (7,711kg) of thrust on reheat, pushing the aircraft beyond Mach 2. Each engine has a five-stage low compressor and a 12-stage high compressor, with two valves to bleed air for de-icing. The J79 first flew in 1958 and remained in production for over 30 years.

A General Electric J79 turbojet engine



Pilot's controls in the front cockpit of the F-4C



COCKPIT ★

The Phantom was designed as a two-seat aircraft on the assumption that the complex, cutting-edge jet would be too overwhelming for a single pilot to manage. The USN versions had a pilot and a 'RIO' (Radar Intercept Officer) from the start, but the USAF initially used two-pilot teams. For the 'GIB' ('Guy In the Back') this was an unpopular assignment, and they soon moved to having a Navigator/Weapon Systems Officer in the back. The crew sat in tandem cockpits, each sealed with a clam-shell canopy. Dual controls could be fitted for flying training, but generally the rear-seat crewman operated the radar and weapons systems.

The F-4 had tandem but separate cockpits



Colonel Robin Olds stands next to his F-4C 'Scat XXVII', now preserved in the US Air Force National Museum



SERVICE HISTORY ★

The F-4 Phantom first entered service with the USN in 1961, and operating from carriers saw its first combat over Vietnam in August 1962. The USAF's F-4C was close behind, entering service in 1964 and from April 1965 flying combat sorties from Thailand with the 45th Tactical Fighter Squadron. Their first air-to-air victory came on 10 July 1965, when an F-4C shot down a Vietnam People's Air Force (VPAF) MiG-17 with an AIM-9 Sidewinder. More combat followed, including during Operation Bolo in January 1967 when 56 Phantoms under Colonel Robin Olds sprang an ambush on VPAF MiG-21s; 28 Phantoms

actually engaged, shooting down between seven to nine MiGs – around half of the VPAF's inventory of MiG-21s at that time.

From 1970, F-4Cs also began to take on ground-attack roles as the F-105 Thunderchief was withdrawn. In October 1972, this was expanded to include 'Wild Weasel' operations, specifically targeting enemy surface-to-air missile batteries. Reconnaissance versions of the F-4C, the RF-4C, remained in service with the USAF until 1990, and the last Phantoms of any type retired in 1996 (ten years after the last USN Phantoms).



**"THEIR FIRST AIR-TO-AIR VICTORY
CAME ON 10 JULY 1965"**



An F-4C modified to 'Wild Weasel' SEAD specifications

COMMISSIONED:	1967
ORIGIN:	USA
LENGTH:	22.4M (73.49 FT)
WIDTH:	19.2M (62.99 FT)
HEIGHT:	5.22M (17.13 FT)
ENGINE:	2 X PRATT & WHITNEY TF30 TURBOFAN
CREW:	2
MAXIMUM SPEED:	2,655 KM/H (1,650 MPH)
MAXIMUM RANGE:	6,760 KM (4,200 MILES)
ARMAMENT:	M61 VULCAN INTERNAL CANNON & MISSION- SPECIFIC ORDNANCE



Despite a shaky beginning, the F-111 became a very **SUCCESSFUL AIRCRAFT** that saw service in the **VIETNAM WAR, LIBYA** and the **GULF WAR**

★ **WORDS: TOM GARNER** ★



The F-111 was a multipurpose American fighter-bomber that was capable of supersonic speeds and achieved one of the safest operational records of any aircraft in USAF history. It was originally designed in the early 1960s with Tactical Air Command wanting an aircraft that could operate from shorter runways. However, the task was complicated by the secretary of defence, Robert McNamara, who directed the US Air Force and US Navy to develop a common aircraft. Both services initially welcomed the joint fighter but there were continuous problems with fixing the plane's weight, engine and drag issues as well as escalating costs, and the Navy backed out. Nonetheless, once the teething problems had been fixed, the F-111 was an outstanding aircraft for the USAF.

Nicknamed 'Aardvark' because of its long-nosed appearance, its pilots described it as "a joy to fly" as it was extremely fast and gave a smooth ride, assisted by its variable sweep wings. These allowed the pilot to fly from slow approaches to supersonic speed at sea level. This impressive performance was enabled by a sophisticated radar system that flew the plane at a constant altitude following the Earth's contours. Consequently, F-111s could fly in valleys or over mountains, day or night, regardless of the weather conditions, and if any of the system's circuits failed the aircraft automatically initiated a climb.

Accordingly, F-111s were perfect for low-level pinpoint strikes on heavily defended targets, flying in so fast that the enemy didn't know about an attack until the bombs exploded. One F-111 crewman who was shot down over Vietnam recalled how a Viet Cong guard quickly slashed his hand sideways and exclaimed to him, "You F-111... whoosh!"



This F-111 was based at Upper Heyford US Air Base in Oxfordshire, England, and is now housed in the American Air Museum as part of Imperial War Museum, Duxford, UK

"F-111s WERE PERFECT FOR
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ARMAMENT ★

The F-111 could carry up to four nuclear weapons with two of the bombs being carried in the internal weapons bay. External ordnance on the wing pylons could include up to 1,500 kilograms of bombs, missiles and rockets. To protect itself, the aircraft was defended with an M61 Vulcan internal cannon. The M61 Vulcan is a six-barrel rotary cannon, which can fire 20 mm rounds at the very high rate of 6,000 rounds per minute. It was designed in 1946 and has been in service with the US military since 1959.



Left and below: The F-111's arsenal was formidable and it was one of the fastest aircraft available that could drop nuclear bombs at short notice



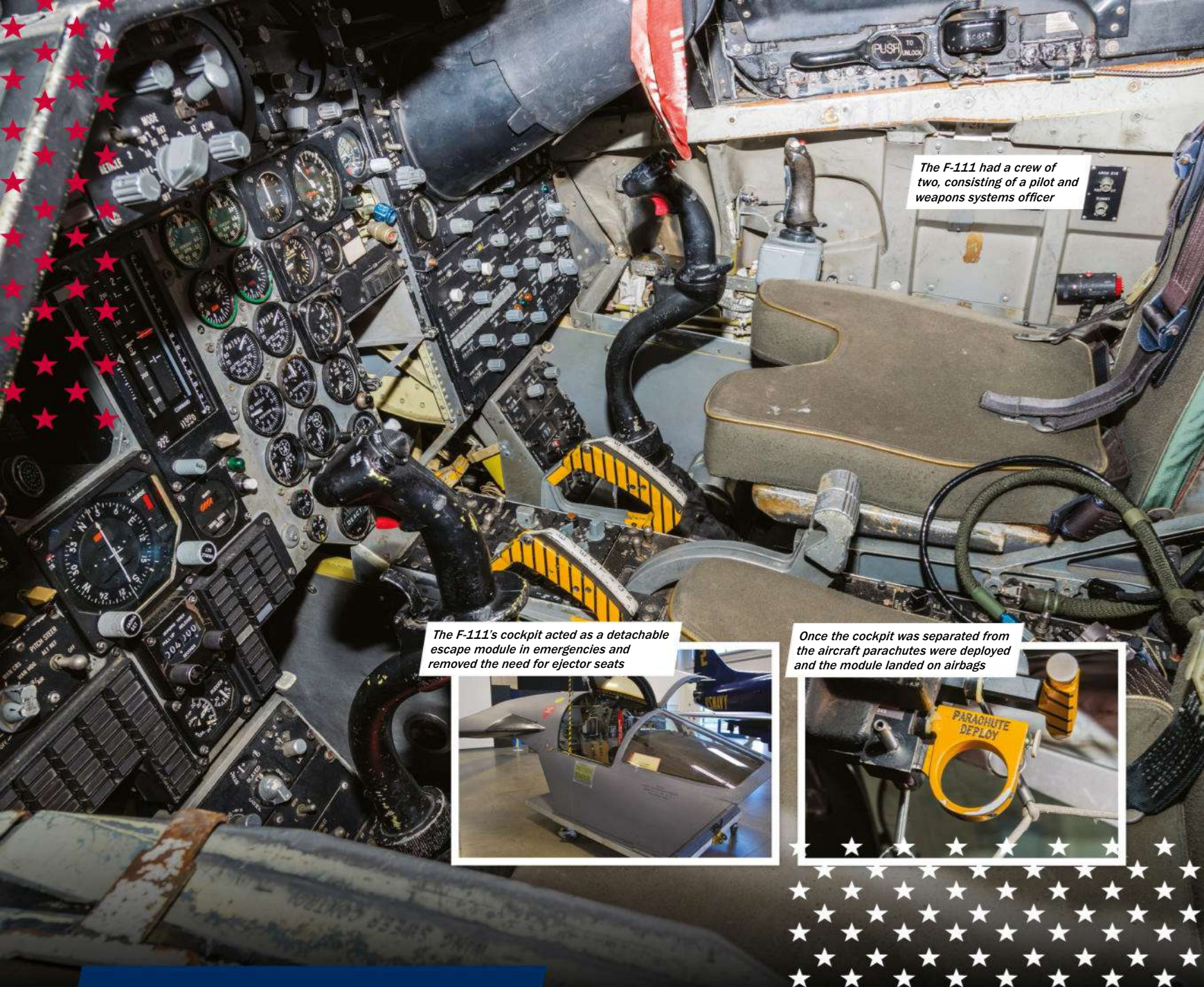
"EXTERNAL ORDNANCE ON THE WING PYLONS
COULD INCLUDE UP TO 1,500 KILOGRAMS OF
BOMBS, MISSILES AND ROCKETS"

F-111s were designed to carry different weapons. This picture from 1981 shows an F-111 mounted with concrete penetration missiles



Left: M61 Vulcan rotary cannon defended F-111s. Its design is based on the 19th century Gatling gun but it can fire over 6,000 rounds per minute

An F-111A dropping 24 Mark 82 low-drag bombs over a range in Nevada in 1980



The F-111 had a crew of two, consisting of a pilot and weapons systems officer

The F-111's cockpit acted as a detachable escape module in emergencies and removed the need for ejector seats



Once the cockpit was separated from the aircraft, parachutes were deployed and the module landed on airbags



COCKPIT ★

Two crew members sat side by side in an air-conditioned, pressurised cockpit that also served as an innovative emergency escape vehicle. It could act as a survival shelter on land or water. In emergencies, an explosive cutting cord separated the cockpit module from the aircraft, which then descended by parachute. Airbags then cushioned the impact and helped the module to stay afloat on water. The cockpit could be released at any speed or altitude, and even underwater. For underwater escapes, the airbags raised the module to the surface after it had been severed from the plane.



F-111s were best utilised as night fighters. Here, a US major runs through a cockpit check before taking the aircraft on a night test flight in 1990

Images: Wiki



**"THE ENGINE'S GREAT SPEED
WAS MATCHED BY A CLEVER
CO-ORDINATION WITH THE
AIRCRAFT'S AVIONICS SYSTEM,
WHICH MEANT THE F-111 COULD
FLY AT MACH 1.2 AT ONLY 60
METRES"**

F-111s had a complex avionics system which included communications, navigation, terrain following, target acquisition and suppression of enemy air defence systems

Two powerful Pratt & Whitney TF30 turbofan engines power the F-111, delivering speeds of over 2,500 km/h

A Royal Australian Air Force F-111C performing a 'dump and burn' at an air show. The fuel is intentionally ignited using the aircraft's afterburner

ENGINES ★

The F-111 was powered by two Pratt & Whitney TF30 afterburning turbofan engines, which made it capable of achieving a top speed of over Mach 2 at 2,655 kilometres per hour. When the aircraft had its maiden flight on 21 December 1964, there were engine problems including compressor surges and stalls. It took the collaboration of the USAF, General Dynamics and even NASA to fix the engine's faults with a major inlet design, but once it was solved, the F-111 became fearsome. The engine's great speed was matched by a clever coordination with the aircraft's avionics system, which meant the F-111 could fly at Mach 1.2 at only 60 metres.

COMBAT SERVICE ★

From September 1972 to March 1973, F-111As flew over 4,000 combat sorties over Vietnam with only six combat losses. This gave the F-111A a loss rate of only 0.015 per cent, making it the most survivable aircraft of the Vietnam War. Over 40 F-111s took part in Operation El Dorado Canyon, the US retaliation raid on Libya after the Berlin bombings in 1986. They performed a night-time raid dropping 54 tonnes of munitions on strike targets with the loss of only one aircraft. Three F-111 squadrons took part in the Gulf War flying large numbers of sorties and were credited with destroying hundreds of Iraqi vehicles and artillery pieces along with selected attacks on Iraqi command centres.



An F-111F releasing its load of Mark 82 bombs. Scenes like this were repeated many times during the Gulf War





OPERATION ROLLING THUNDER

A costly sustained **US BOMBING CAMPAIGN**
against North Vietnam yielded mixed results

★ WORDS: MICHAEL E HASKEW ★



bombing campaign, escalating the nation's involvement in the Vietnam War.

Operation Rolling Thunder was undertaken ostensibly to raise the flagging morale of the South Vietnamese people in their protracted conflict with a well-organised, determined communist insurgency and stifle the ability of North Vietnam to continue funneling support to Viet Cong guerrillas in the South by disabling the country's industrial and transportation complexes. From the outset these goals were difficult to quantify, and strategic success was tempered by the prerequisite that air strikes would not provoke the direct military intervention of the Soviet Union or the People's Republic of China, North Vietnam's communist benefactors.

As 3,500 US Marines splashed ashore at Da Nang, Rolling Thunder was undertaken primarily by US Air Force planes flying from bases in South Vietnam and Thailand, and the US Navy, with the carrier-based planes of Task Force 77 deployed from Yankee Station in the Gulf of Tonkin. Marine Corps and South Vietnamese aircrews also participated.

Operation Rolling Thunder ebbed and flowed across the skies of North Vietnam for

44 months. A total of 922 American aircraft were shot down, with 1,054 personnel killed, wounded or captured. Estimates of North Vietnamese civilian and military casualties range from 30,000 to 200,000. Flying over 300,000 combat sorties, American planes expended more ordnance – 864,000 tons of bombs and missiles – against North Vietnam than during the entirety of the Korean War (653,000 tons) or the Pacific theatre during World War II (503,000 tons).

Rolling Thunder, however, was a limited offensive and the concept itself is a

“ROLLING THUNDER EBBED AND FLOWED ACROSS THE SKIES OF NORTH VIETNAM FOR 44 MONTHS”

contradiction in terms. Potential targets were identified, evaluated and then approved or denied by civilian and military war planners, including President Lyndon B Johnson himself, whose understandable concerns about limiting civilian casualties and reticence for attacking population centres negatively impacted the strategic optimisation of the air effort. Heavy bombing of Hanoi, the North Vietnamese capital, and mining the harbour of Haiphong, made military sense, but inherently restrictive rules of engagement prohibited such initiatives.

American commanders were further hesitant to deploy the potentially decisive Boeing B-52 Stratofortress heavy bomber in significant numbers, and therefore the majority of Rolling Thunder missions were flown by other aircraft, such as Air Force, Navy and Marine Corps McDonnell Douglas F-4 Phantoms, Air Force F-105 Thunderchiefs and the Navy A-4 Skyhawk, A-6 Intruder and A-7 Corsair.

Operation Rolling Thunder was directed primarily at North Vietnamese infrastructure, such as bridges, railroads and roadways, as well as ammunition dumps, barracks, oil and fuel depots, power plants and storage facilities. Some targets were heavily damaged in the attacks, but repairs were often accomplished quite efficiently. During the first month of air operations a total of 26 bridges in North Vietnam were destroyed.

As Rolling Thunder wore on, however, North Vietnamese air defence capability steadily improved. The Soviet Union and China supplied a variety of anti-aircraft guns, along with MiG-17 and MiG-21 fighter planes and the S-75 Dvina air-defence system, which deployed the deadly SA-2 Guideline radar-directed surface-to-air missile. In time Hanoi and its environs were ringed with the heaviest concentration of sophisticated air-defence weaponry in history. Although American planes were sometimes authorised to hit enemy radar sites, airfields remained off limits.

North Vietnamese fighters began to conduct hit-and-run attacks on American F-105



*A destroyed textile factory in
Nam Dinh, North Vietnam*



formations, quickly disengaging and returning to their bases, some actually located in China. When opposing aircraft engaged in dogfights, kill ratios fluctuated but usually favoured the Americans. US Navy fliers, for example, shot down 29 enemy planes during Rolling Thunder, while losing only eight to MiG pilots. The vast majority of American combat losses were attributed to anti-aircraft guns and missiles. A total of 170 downed Navy airmen, including

future senator John McCain, were held prisoner in the North, and the 160 who survived brutal internment were finally released in 1973. Among the Air Force personnel captured, Lieutenant Colonel James Robinson Risner, who led the very first Rolling Thunder mission, was shot down in September 1965. He was held prisoner for over seven years.

Operation Rolling Thunder was terminated on 2 November 1968, as President Johnson

hoped to bring North Vietnam to the negotiating table and end the Vietnam War. Historians have debated the costs and benefits of Rolling Thunder ever since. While some assert that the nature of the limited offensive indeed delivered limited gains, others contend that it was destined to fail due to the exigencies of 'limited war' that prevented a global superpower from sufficiently flexing the muscle of potentially overwhelming air strength.

*A US reconnaissance
plane, its shadow
photographed, confirms
the destruction of a North
Vietnamese bridge*



*Four F-105 Thunderchief
bombers drop payloads
above a target in North
Vietnam during Operation
Rolling Thunder*



Images: Alamy, Wiki

*The Predator drone
unmanned aerial vehicle
(UAV) brought a new
dimension to US Air
Force combat capability
by the 1990s*

*The McDonnell Douglas
F-15 Eagle air superiority
fighter plane became
operational with US Air
Force squadrons in quantity
by the late 1970s*

*The US Air Force's F-22
Raptor stealth fighter was
well into development by
the mid-1990s – evidence
of a surge in technology*



INTERCEPTION AND INVENTION

The 'Hollow Force' period was followed by a resurgence of **AIR FORCE**
EFFICIENCY and **TECHNOLOGY** from the 1970s to the 1990s

★ WORDS: MICHAEL E HASKEW ★



he post-Vietnam era constituted a winnowing and then a period of relative famine that led to the description of combat efficiency across the US military

as that of a 'Hollow Force'. The supposed decline of the military was a direct result of national malaise and popular unfavourability of the armed forces following the debacle of Vietnam, which contributed to significant spending cuts and reduction of overall manpower and capability.

The US Air Force was not alone in this period that could be likened to a wandering in the wilderness. Beneath the outward signs of a decline, as evidenced by the shrinkage of the Air Force from 742,000 active personnel in 1970 to 495,000 a decade later, a full 33 per cent decrease, was a real concern that the American military could not fulfill its obligations around the world. Such circumstance was said at the

time to embolden the expansionist adventurism of the Soviet Union and other adversaries.

Poor morale in the military, along with an early slowdown in the introduction of new types of weaponry and even periodic shortages of parts with which to keep available aircraft operating, led to tough and anxious times. Air Force combat efficiency suffered as real flying time among pilots dwindled, while low pay and long overseas deployments made life difficult for those who chose to remain in the service.

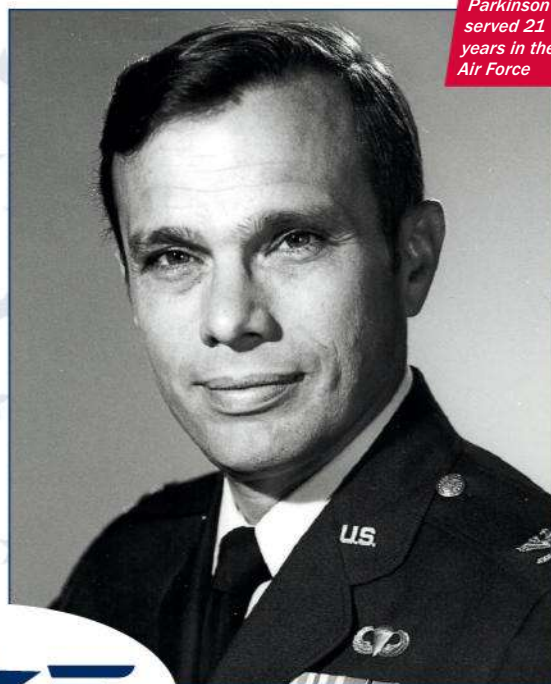
By 1980, however, a resurgence in technology had already begun to surface. New types of aircraft, such as the McDonnell Douglas F-15 Eagle and General Dynamics F-16 Fighting Falcon air superiority and multi-role fighters were nearing deployment readiness, while investment in other aircraft types along with rapidly advancing stealth and unmanned aerial vehicle (UAV) drone technology were proceeding.

When President Ronald Reagan took office in 1980, he vowed to rehabilitate and upgrade the US armed forces, and the Air Force was a

critical element in the new emphasis on the Reagan doctrine of peace through strength. The President once commented, "We had fighter planes that couldn't fly, Navy ships that couldn't leave port, a Rapid Deployment Force that was neither rapid nor deployable and not much of a force."

The result of the emphasis placed on combat readiness was displayed to the world by the early 1990s. During the Gulf War of 1990-91, the Coalition forces led by the United States swiftly ejected Iraqi forces from neighbouring Kuwait, and the Air Force was a prime mover in the success of the endeavour. F-15s and F-16s achieved rapid air superiority, ravaged enemy strong points and command and communications centres, and destroyed hundreds of Iraqi military assets. The F-117 Nighthawk stealth fighter and so-called 'smart weapons' were further indications of resurgent Air Force capability and will to win.

Later in the 1990s, the Air Force participated in numerous operations in the Middle East and the Horn of Africa.



Parkinson served 21 years in the US Air Force

© USAF



THE FATHER OF GPS

Bradford Parkinson is the engineer behind the **NAVIGATION SYSTEM** that we rely on daily



ir Force Colonel Bradford Parkinson was lead architect for the Global Positioning System (GPS) program. In 1973 he convinced the US Air

Force of the value of a new satellite-based navigation system. By building satellites and experimenting to improve them, Parkinson and his team provided the world with accurate positioning, navigation and timing services. The first GPS satellite was launched into space just 44 months after the team's program was approved. Parkinson went on to become a professor at Stanford University in 1984, the same university that he graduated from with a PhD in guidance control navigation. There he continued to explore the multitude of applications his team's satellite service could achieve, including robotic tractors. From the maps on our phones to real-time aircraft positioning for pilots, Parkinson's lead role in this groundbreaking technology has resulted in some declaring him the 'father of GPS'.

HOW DID YOU GET INTO ENGINEERING?

I don't think I ever thought of myself as anything other than an engineer. It was not a serious question to me. When I was young, I made electronic amplifiers from scratch. This was back in the era of vacuum tubes, and they were all discrete components. I went to the US Naval Academy in Annapolis and education

there was principally engineering, so I felt right at home. I graduated and went out in the Air Force as an engineering officer, and there I was trained in aircraft avionics.

WHOSE IDEA WAS IT TO CREATE GPS?

There had been a previous satellite navigation system called Transit. It was, by our standards, quite crude, but it was worldwide. GPS can provide 24/7, 365 days a year coverage to the whole Earth, and Transit couldn't do that. It would give you a relatively crude fix once every two or three hours. It was good enough for some Navy ships, but it wasn't good enough to land aeroplanes. A study was done, and 12 techniques were highlighted as ways to navigate using space satellites. We selected the hardest, which provided four dimensions: latitude, longitude, altitude and very precise time.

Two important breakthroughs had to occur. First we had to come up with a signal that was very unique. Back then we were experimenting with a new signal that was so quiet that if you looked at the radio spectrum you wouldn't see it at all. Now everyone accepts it as a GPS signal, but there was great scepticism that it could be good enough to navigate. Today we navigate to a millimetre with it.

Secondly, we wanted the satellites to go around the Earth, be autonomous and have clocks with stability better than one second in 300,000 years. We were trying to measure time

to a fraction of a billionth of a second.

HOW DID THE AIR FORCE RESPOND?

The Air Force did not want this system; they fought it tooth and nail. I got in a lot of trouble in the Pentagon. I remember the two-star general taking his finger and sticking it in my chest and saying: "Parkinson, if you keep advocating this your career is going to go down in flames."

WHY DIDN'T THEY WANT IT?

They wanted aeroplanes, not satellites. It cost a lot of money, and they couldn't envision what precision would do for them. Even after we ran the tests and met every single one, the Air Force still tried to cancel the whole thing. Now the Air Force fully embraces it. The reason the signal is so reliable – and it is very reliable at 99.98 per cent on any given satellite, and for the whole system even better – is because it is operated by young Air Force sergeants and lieutenants. Everyone says that's not a good idea, but these are great people, really good people. I'm proud of them.

HOW DID THE AIR FORCE COME TO ACCEPT IT?

They were forced to accept it. It turned out Dr Mal Currie, who was in charge of all the development for the whole Department of Defense, had come to our offices. He was a bright guy with a PhD in physics. I spent three

hours with him – it was just me, a very young colonel and group captain, and the Defense Department's development leader. And at the end of that time, he emerged and became a champion of us.

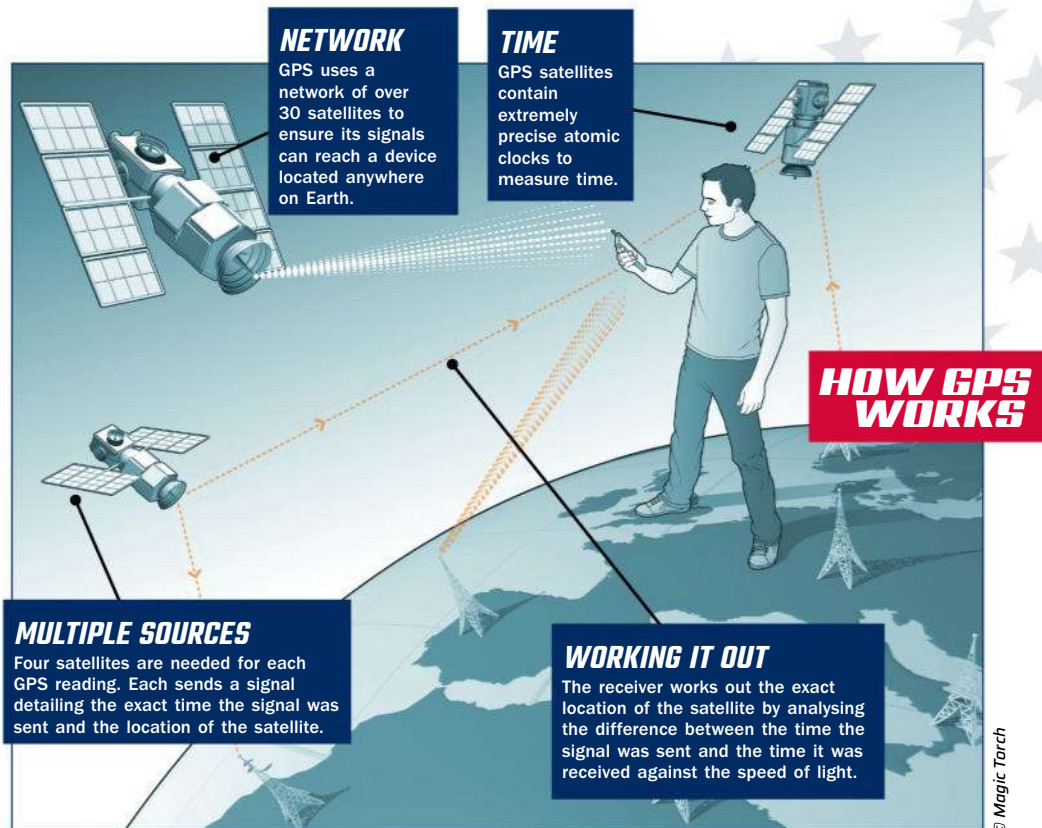
WHO WAS ON YOUR TEAM?

Within my office there were 50 or 60 Air Force officer engineers that I had hand-picked. In almost all cases, they were officer engineers who worked with real hardware. They typically had master's degrees from MIT, Stanford, Michigan – the big engineering schools. Six of us had PhDs. This was an extremely competent group of people. When asked if a lot of people worked for me, I like to say they were working with me. They were working for me, but these were the kind of people you admire, and I trusted them. It was sort of like combat.

WHAT OTHER CHALLENGES DID YOU FACE?

Early on I realised I was getting really stressed leading this, but I had a solution. At noon I wouldn't eat lunch. I would go and run. I'd been in the office from seven to noon, and by that time the problems had gotten pretty thick. Running was sort of a zen thing. I would contemplate the problems, and by the time I came back to the office I knew what to do. It was important.

Usually I'd run alone, but because my schedule was full, my guys knew that if they couldn't get in to see me, they could run with me and talk about anything they wanted. On Fridays we'd all start running as a big band of 10 or 12 of us, and I was a pretty fast runner back then. We were doing these big two mile loops, and I would hold it at eight-minute miles. The guys that had something to talk about would run the first two miles, and those who could would run the next two, until there was just one lieutenant. Boy, was he fast.



As soon as everyone else left, we'd pick up the pace and finish off the ten miles. I got into marathoning, and I would say at least a dozen of my officers became marathoners. They did have a saying: 'Run for your career'.

BEFORE GPS LAUNCHED, WHAT DID YOU THINK THE MOST BENEFICIAL APPLICATION WOULD BE?

I knew that the Air Force in World War II had to do, in essence, carpet bombing. What was called 'precision weapon delivery' was if they dropped a bomb within a quarter mile of the target. And I was saying: "Let's do that

within 30 feet [nine metres]." Precision was the number-one purpose in my mind, so that when the military decides it has to take out a target, that it was that target, and not a mosque, or a school or a hospital. I called it a weapon system for humanity. That sounds strange, but to me that's what it was.

I also recognised that there were civilian applications. From the get-go I declared that there was going to be a civil signal available. We weren't going to guarantee accuracy, but it was going to be available. Within 24 hours of turning that satellite on, the students under Peter Daly at the University of Leeds, UK, became the first civil set to use the very first satellite we launched.

ARE THERE ANY CURRENT GPS APPLICATIONS YOU DIDN'T EXPECT?

There's all kinds of them. I knew we could position to a metre or two, and I knew there was a technique to get down to millimetres, but it involves a signal-processing technique that I didn't think was robust. Engineers proved me wrong. If you can do that, you can use it for automatic landing of aeroplanes. In your cell phone there is a little chip that costs about \$2 [£1.50]. It has roughly 10,000 times the capability of the receivers that we built for a quarter million dollars. If you have accuracy, and it's cheap and affordable, all of a sudden the whole world opens up. It's a tribute to engineers who keep building on the previous generation and making things bigger, better and cheaper. I didn't expect these applications. I envisioned some things, but at the time I envisioned them it demanded both that the accuracy would be improved and that the cost had to go down.

© Queen Elizabeth Prize for Engineering



Parkinson received a Queen Elizabeth Prize for Engineering in 2019 for his contributions to GPS

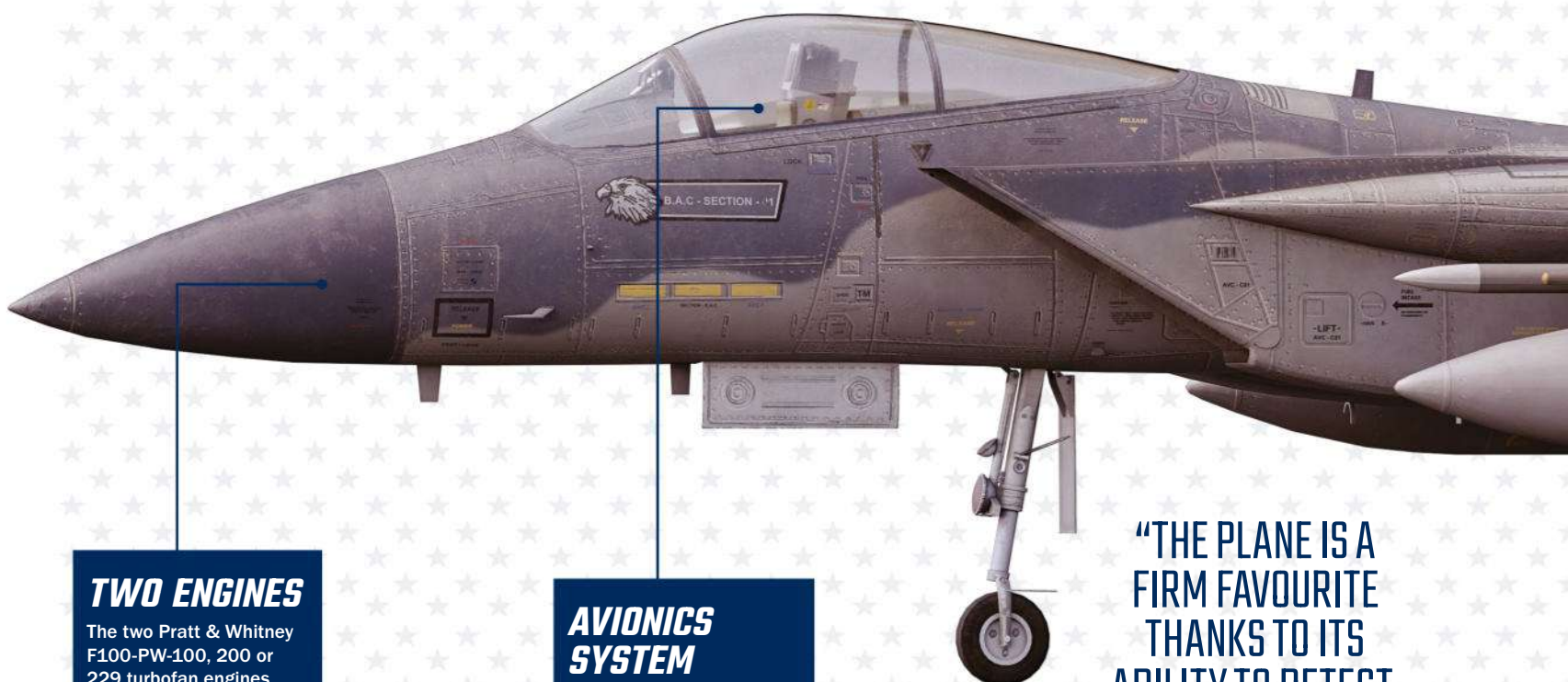
© Magic Torch

Images: Getty



F-15 EAGLE

This American twin-engine plane is one of the ***MOST SUCCESSFUL*** modern fighters



TWO ENGINES

The two Pratt & Whitney F100-PW-100, 200 or 229 turbofan engines with afterburners were originally asked for as it was believed that twin engines would be able to respond to throttle changes more rapidly.

AVIONICS SYSTEM

The cockpit of an F-15 houses a multimission avionics system, which includes advanced radar and a system that can identify friend and foe.

"THE PLANE IS A FIRM FAVOURITE THANKS TO ITS ABILITY TO DETECT, ACQUIRE, TRACK AND ATTACK ENEMY AIRCRAFT"



In 1972, the F-15A took to the air for the first time. It was the prototype for what would become a flagship fighting plane for the US Air Force just two years later, when the first F-15 Eagle was delivered in November 1974. The Eagle officially became a part of the US Air Force 14 months later.

The F-15 has been a major part of American military operations. The C, D and E models saw a lot of use in the Gulf War – most notably, Operations Desert Shield and Desert Storm in 1990. During the entirety of the conflict, McDonnell Douglass – the designers of the

F-15 – could boast that their fighter jet had won 36 of the United States' 39 air-to-air victories against Iraqi forces.

It wasn't just the US that recognised the F-15 as a powerful fighter. Japan's Air Self-Defense Force has 200 Mitsubishi F-15Js, and the Royal Saudi Air Force had 211 F-15s in its ranks at the last count in 2022. The Israeli Air Force is another fan, having used F-15s since 1977 and having 84 in service as of 2022. In fact, it was Israeli Air Force ace Mishe Melnik who scored the first confirmed kill by an F-15 in 1979, during Israeli raids against Palestinian factions in Lebanon.

McDonnell Douglass has brought out several new models of the F-15 over the years: the single-seat C and two-seat D models were brought into the US Air Force in 1979. The plane is a firm favourite with the USAF thanks to its ability to detect, acquire, track and attack enemy aircraft, and its design allows one person to safely and effectively perform air-to-air combat.

The F-15 is a highly maneuverable plane thanks to its high engine thrust-to-weight ratio and low wing loading, and a multimission avionics system that most other fighter aircraft don't have.

An F-15 Eagle is pictured here, flying through a storm



WEAPONRY

An F-15 gives the military a choice of weaponry; there's one internally mounted six-barrel cannon, and up to eight AMRAAMs can be carried externally.

This F-15 Eagle is flying in the Mach Loop valleys in Wales



F-15 EAGLE

COMMISSIONED:	1972
ORIGIN:	USA
LENGTH:	19.43M (63FT 9IN)
WINGSPAN:	13.06M (42FT 10IN)
RANGE:	5,552KM (3,450M)
ENGINE:	2X PRATT & WHITNEY F100-PW-100, 220 OR 229 TURBO FAN ENGINES WITH AFTERBURNERS
CREW:	1
WEAPONS:	1X 0.787IN (20MM) M61A1 VULCAN 6-BARREL
ROTARY	CANNON, 4X AIM-9 SIDEWINDER & 4X AIM-120 AMRAAMS OR 8X AIM-120 AMRAAMS, CARRIED EXTERNALLY

The F-15 has experienced no losses in aerial combat so far

"THE COCKPIT OF THE F-15 HOUSES A MULTIMISSION AVIONICS SYSTEM THAT IS SELDOM SEEN ELSEWHERE"

ARMAMENT ★

The F-15 is ready to perform in air-to-air combat and as part of a ground-attack fleet, with its equipment and armaments improved over the years. The A, C and D models are able to hold AIM-120 (AMRAAM), -9 (Sidewinder) and -7 (Sparrow) missiles on the pylons under the wings, while the F-15E comes equipped with precision guided munitions and a variety of payloads. There is also an internally mounted M-61A1 20mm six-barrel cannon with 940 rounds of ammunition in the right wing foot.



Some models of the F-15 Eagle are equipped with missiles under the wings

COCKPIT ★

The cockpit of the F-15 houses a multimission avionics system that is seldom seen elsewhere. This includes a head-up display, advanced radar, an inertial navigation system and instrument landing system. The head-up display is projected onto the windscreen and displays all essential flight information gathered by the integrated avionics system.

Depending on the model, F-15s can seat either one or two people in the cockpit, but the pulse-Doppler radar system means that high- and low-flying targets can be tracked at any speed without being confused by any ground clutter.



A US Air Force F-15 Eagle is pictured here, releasing flares while in a vertical climb

DESIGN ★

The fuselage of the F-15 is all metal and semi-monocoque, with a large-cantilever, shoulder-mounted wing. Twin vertical tails are mounted at the rear of the short fuselage, and large horizontal-ramp variable-geometry external-compression inlets are located on the sides of the fuselage ahead of the wing.

The main purpose of the F-15 was to dominate airspace as an air superiority fighter. This aim was certainly achieved thanks to its design, weaponry and technical specifications, with the plane still in use after five decades.



The F-15 is an all-weather tactical fighter that can achieve air supremacy

Images: Alamy, Getty



A10 WARTHOG

Slow but steady, this Cold War close-air-support aircraft is a **FAVOURITE OF FRIENDLY GROUND FORCES** and recognised by the buzz of its 30mm cannon

★ WORDS: TIMOTHY WILLIAMSON ★



The A-10 Thunderbolt is a single-seat, close-air support fighter jet that also goes by the names Warthog and Tankbuster. Developed for the US Air Force by Fairchild Republic Company (now Northrop Grumman), the original commission

was for a low-altitude, low-speed close air support aircraft. Work on prototypes began in 1967 and its first flight was in 1972. There are several reasons why the A-10 has weathered 40-plus years of advancing military technology – chief among them its versatility and high survival rate.

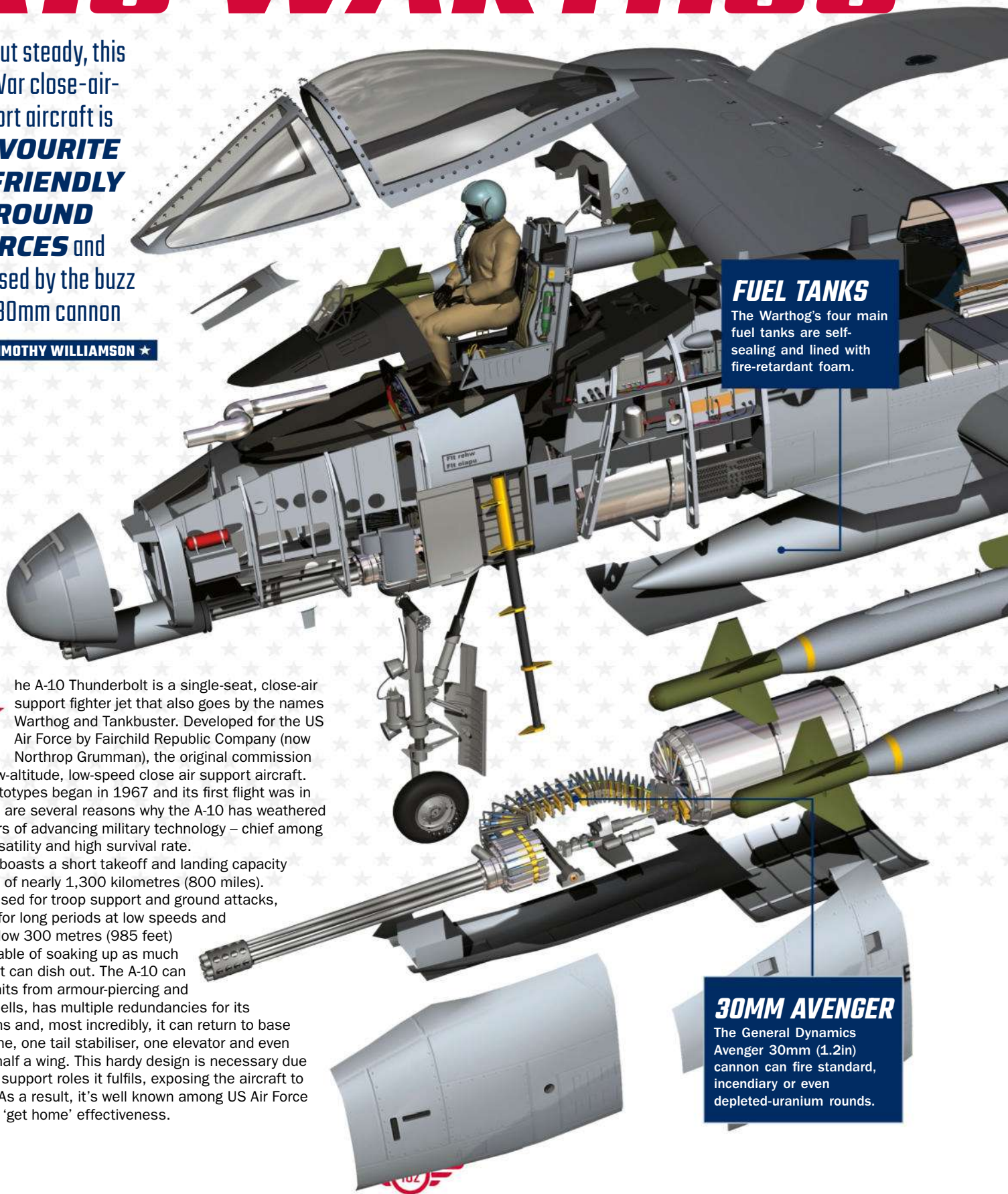
The A-10 boasts a short takeoff and landing capacity with a range of nearly 1,300 kilometres (800 miles). Commonly used for troop support and ground attacks, it can loiter for long periods at low speeds and altitudes below 300 metres (985 feet) and it's capable of soaking up as much damage as it can dish out. The A-10 can take direct hits from armour-piercing and explosive shells, has multiple redundancies for its flight systems and, most incredibly, it can return to base on one engine, one tail stabiliser, one elevator and even having lost half a wing. This hardy design is necessary due to the close support roles it fulfils, exposing the aircraft to ground fire. As a result, it's well known among US Air Force pilots for its 'get home' effectiveness.

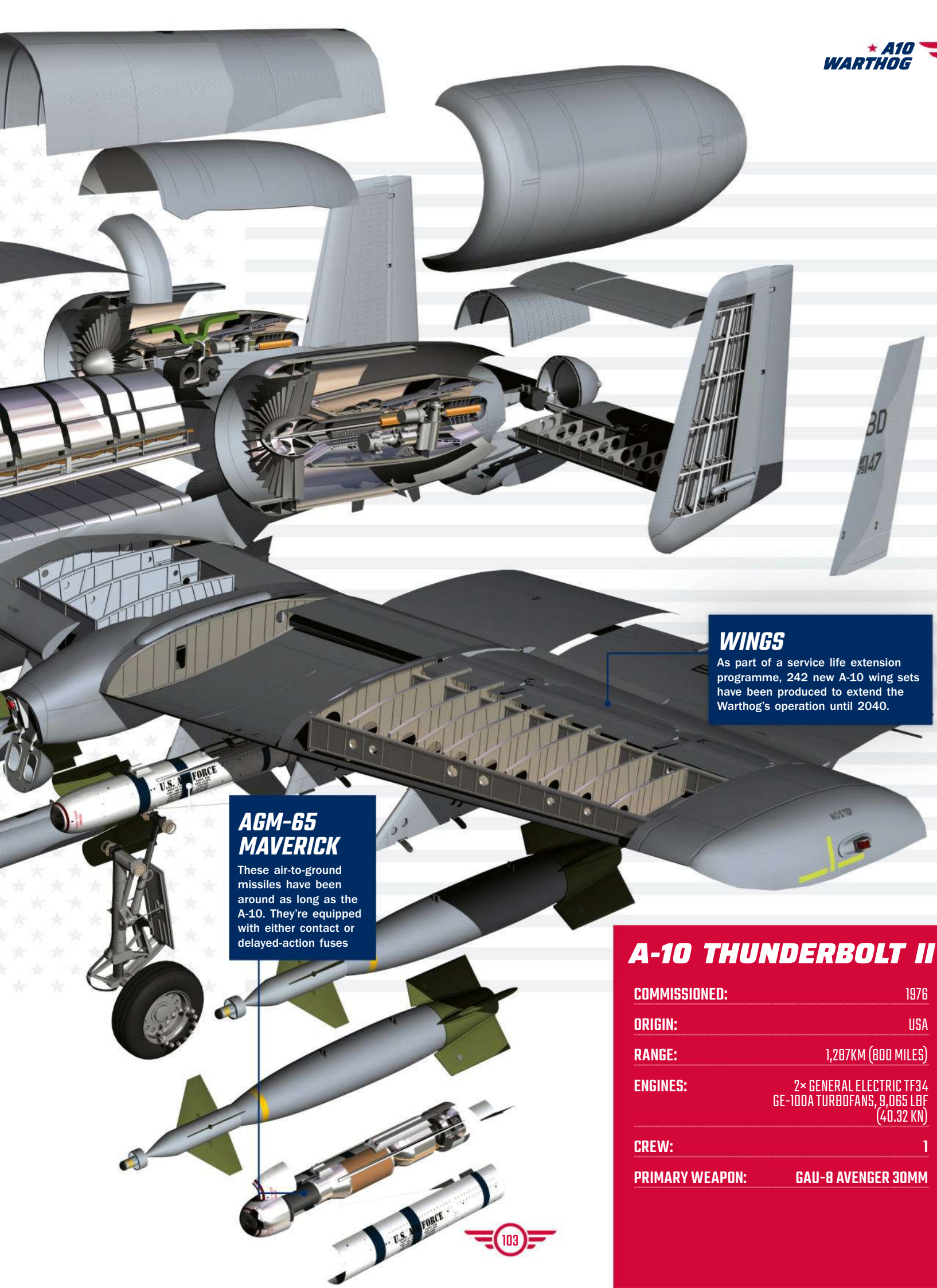
FUEL TANKS

The Warthog's four main fuel tanks are self-sealing and lined with fire-retardant foam.

30MM AVENGER

The General Dynamics Avenger 30mm (1.2in) cannon can fire standard, incendiary or even depleted-uranium rounds.





WINGS

As part of a service life extension programme, 242 new A-10 wing sets have been produced to extend the Warthog's operation until 2040.

AGM-65 MAVERICK

These air-to-ground missiles have been around as long as the A-10. They're equipped with either contact or delayed-action fuses

A-10 THUNDERBOLT II

COMMISSIONED:	1976
ORIGIN:	USA
RANGE:	1,287KM (800 MILES)
ENGINES:	2× GENERAL ELECTRIC TF34 GE-100A TURBOFANS, 9,065 LBF (40.32 KN)
CREW:	1
PRIMARY WEAPON:	GAU-8 AVENGER 30MM

*The huge engines provide
4,111kg (9,065lb) of thrust*



*A-10C Thunderbolt
II being refuelled at
Plovdiv, Bulgaria*

POWERPLANT ★

Two TF34-GE-100, non-afterburning, twin turbofans provide 4,111kg (9,065lb) of thrust each. The engines are mounted above the airframe to reduce heat signature (for evading heat-seeking missiles), as well as to enable the pilot to fly the aircraft with one engine out of action.



*A US Air Force
technician performs
maintenance on
an A-10 Thunderbolt II*





“THE ENGINES ARE MOUNTED ABOVE THE AIRFRAME TO REDUCE HEAT SIGNATURE (FOR EVADING HEAT-SEEKING MISSILES), AS WELL AS TO ENABLE THE PILOT TO FLY THE AIRCRAFT WITH ONE ENGINE OUT OF ACTION”

An A-10 Thunderbolt II takes flight at Eielson Air Force Base, Alaska



An A-10 Warthog fires a Maverick missile during a training mission



AVIONICS ★

Modern A-10s have been upgraded from the original 1972 blueprint, with navigation and targeting systems dramatically improved. In the 1980s Low Altitude Safety and Targeting Enhancement was installed, which included a computerised weapons operation and a low-altitude collision warning system. A-10s were fitted with Night Vision Imaging Systems in the 1990s, enabling pilots to operate in low-visibility conditions, while after the turn of the century they received Precision Engagement upgrades, which modernised flight controls, navigation and the fire control system – these updated Warthogs are now designated A-10C.

Images: Wiki



ARMAMENT ★

The A-10 can carry nearly half its weight again in armaments and their associated systems, with an external load of up to 7,260 kilograms (16,005 pounds). It's equipped with 11 pylons along which laser weapon guidance and support systems can be attached, plus ordnance. It's capable of carrying a range of cluster and 227-kilogram (500-pound) general-purpose bombs, Hydra rockets, plus up to ten Maverick air-to-ground missiles weighing 304 kilograms (670 pounds) apiece. The latter can destroy a tank in a single hit – however, at a cost of up to £105,000 (\$160,000) a pop, a cavalier attitude with the Mavericks is not tolerated. The Warthog's main weapon is the Avenger 30-millimetre (1.2-inch) cannon mounted under the nose of the A-10, with a top fire rate of 4,200 rounds a minute and an effective range of over 6.5 kilometres (4 miles). The cannon can easily disable a main battle tank in the hands of a competent pilot.

An A-10 Thunderbolt II with serpentine nose art around the Avenger cannon

COCKPIT ★

The A-10 was designed to sustain heavy damage during combat, and is particularly well-armoured around the cockpit, to increase its survivability. Sensitive parts of the flight control system, along with the pilot, are shielded by a 'tub' of titanium armour: 544 kilograms (1,200 pounds) of this super-hard metal is layered in plates up to 3.8 centimetres (1.5 inches) thick around the cockpit, based on the likely trajectories of incoming projectiles. It can withstand fire from similar cannons to its own main weapon, as well as large-calibre rounds. A nylon spall shield also protects the pilot from shrapnel and round fragmentation, while the transparent canopy (which can't afford the same level of protection) can still resist ballistics from small arms.



The interior of an A-10C Warthog's cockpit



Pilots are protected from shrapnel by a nylon spall shield



Capt Todd Campbell
SrA Collin Reaves

An Air Force A-10 Thunderbolt II flies in an undisclosed location during Operation Inherent Resolve

"THEIR STRAFING RUNS AND THE CHARACTERISTIC BUZZ OF THE 30MM CANNON HAVE GAINED HUGE POPULARITY AMONG INFANTRY ON OPERATIONS AGAINST ISIS IN IRAQ"

SERVICE HISTORY ★

After its first introduction in the late 1970s, the A-10 did not instantly gain the affection and respect it would later enjoy – its cumbersome low speed earned it the disparaging nickname 'Warthog' among fast jet pilots. Nonetheless, the aircraft's ability to fly at low altitude and provide accurate ground support was deemed essential for the US military, whose experience in Vietnam had exposed major gaps in USAF's close-air-support capacity.

Though it was too late to impact the Vietnam War, the A-10 nonetheless soon began earning a reputation for its dependability and resilience. After the end of the Cold War, A-10s participated in the first Gulf War and later during the Kosovo conflict. Though over 20 years old by the 21st century, Warthogs also took part in the 2003 Invasion of Iraq. Their strafing runs and the characteristic buzz of the 30mm cannon have gained huge popularity among infantry on operations against ISIS in Iraq and Syria, as well as in Afghanistan and elsewhere.



An A-10 Thunderbolt II deploys its flares over Afghanistan



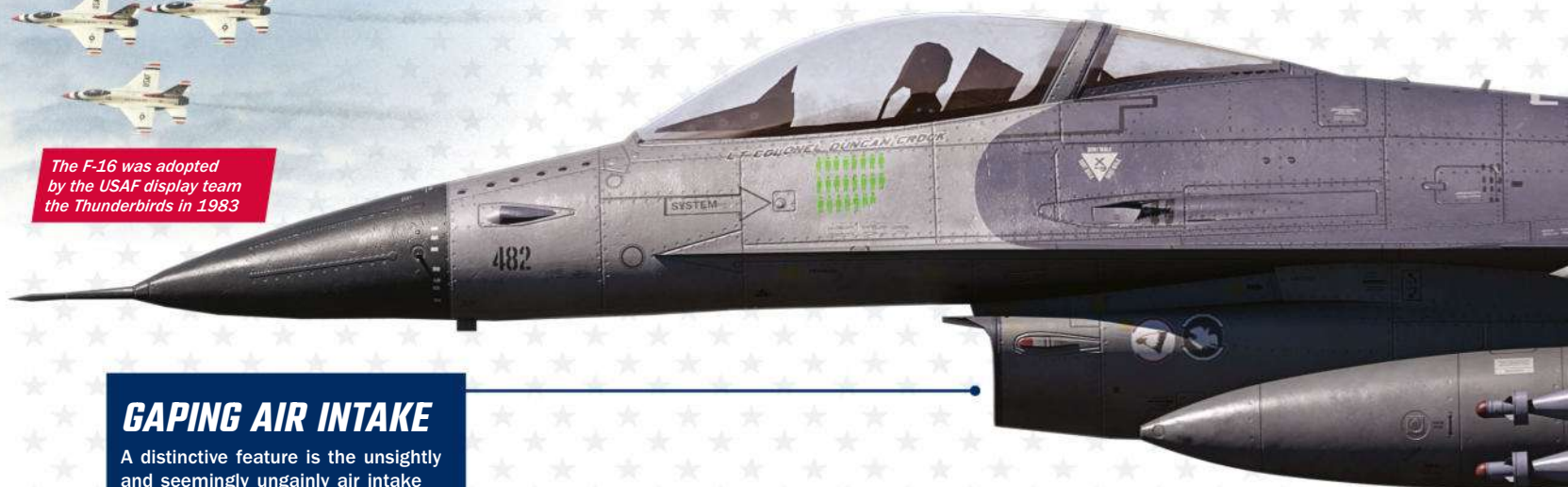
F-16 FIGHTING FALCON

Arguably the world's most **SUCCESSFUL JET FIGHTER**,
the Fighting Falcon has served in nations around the world, in
conflicts spanning decades

★ WORDS: STUART HADAWAY ★



The F-16 was adopted
by the USAF display team
the Thunderbirds in 1983



GAPING AIR INTAKE

A distinctive feature is the unsightly and seemingly ungainly air intake under the cockpit. It is set far enough back to reduce drag and minimise air-flow loss. A splitter plate is used to control air flow.

**"THE F-16 WOULD LATER BE DEVELOPED INTO A HIGHLY
CAPABLE ALL-WEATHER MULTI-ROLE AIRCRAFT"**



The General Dynamics (later Lockheed, then Lockheed Martin) F-16 Fighting Falcon is widely regarded as the world's most successful jet fighter. Designed in the early 1970s to meet a US requirement for a low-cost, low-weight fighter, it came after decades of building heavy fighters designed as interceptors or strike attack aircraft. Experience in the Vietnam War convinced the military of the need for a pure-bred dogfighter – lean, light and agile. Ironically, the F-16 would later be developed into a highly capable all-weather multi-role aircraft with a formidable ground-attack ability.

Even as the US Air Force (USAF) was announcing the adoption of the F-16 in 1975, a European group including Belgium, the Netherlands, Denmark and Norway also declared their intention to purchase it. It would be the start of a prodigious overseas career for the aircraft. During its history, around 25 other countries would operate the F-16 (and several more have considered ordering the type), and the aircraft would be licence-built in several of those countries. Both Israel and Pakistan would use the type in combat before the US did, and, with over 4,500 built, it continues to be one of the most numerous and widely used fighters in the world.

GENERAL DYNAMICS F-16 FIGHTING FALCON

COMMISSIONED	1972
ORIGIN	USA
LENGTH	49FT 5IN (15.06M)
WINGSPAN	32FT 8IN (9.96M)
ENGINE	1X GENERAL ELECTRIC F110-GE-129 OR PRATT & WHITNEY F100-PW-229 AFTERBURNING TURBOFAN
CREW	1
PRIMARY WEAPON	UP TO 16,975LB (7,700KG) OF AIR-TO- AIR MISSILES, BOMBS OR ROCKETS
SECONDARY WEAPON	M61A1 VULCAN ROTARY CANNON



VARIABLE-CAMBER WINGS

Flaperons along the leading and trailing edges of the wings are automatically controlled by the on-board computer, varying the camber of the wings to maximise performance.



CLOSE-SET UNDERCARRIAGE

The F-16 has a close-set and surprisingly simple tricycle undercarriage. In order to keep the wing thin, it folds into the lower fuselage.



A Turkish Air Force F-16 demonstrates its self-defence suite

FULLY MOVING STABILISERS

After some early stability issues, the F-16 was fitted with larger and fully moving horizontal stabilisers, improving performance at high angles of attack, assisting with stall recovery and aiding faster take-offs.

ARMAMENT ★

The F-16 has a 20mm M61A1 Vulcan six-barrelled cannon in the fuselage to the left of the cockpit, and also carries a fearsome array of other weaponry. Initially designed to carry two AIM-9 Sidewinder missiles, one on each wing tip, continuous developments have seen the number of hard-points rise to 11, of which nine can carry ordnance (the others carrying sensors and other systems) or external fuel tanks. Up to 16,975lb (7,700kg) of air-to-air or air-to-ground missiles, iron and smart bombs, or rockets can be carried to meet almost any mission requirement.

US Air Force Major Todd Pierce, a pilot with the 451st Expeditionary Fighter Squadron, inspects the bombs and missiles on an F-16C Fighting Falcon, at Kandahar Airfield, Afghanistan, April 2012



"UP TO 16,975LB (7,700KG) OF AIR-TO-AIR OR AIR-TO-GROUND MISSILES, IRON AND SMART BOMBS, OR ROCKETS CAN BE CARRIED TO MEET ALMOST ANY MISSION REQUIREMENT"



An F-16 drops two laser-guided bombs over a range

The F-16 has nine weapons pylons – one on each wing tip, three under each wing and one under the fuselage. The wing tip pylons are typically used for air-to-air missiles



DESIGN ★

With wing-body blending and a cropped delta wing swept back at 40°, the F-16 has a sleek look marred only by the gaping air intake under the nose. Light and strong, it can perform at up to 9G and exceed Mach 2, with its agility improved by 'relaxed static stability'. This essentially means that the aircraft is inherently unstable, with numerous adjustable sections around the wings and fuselage automatically trimming the aircraft in normal flight. Every aspect of the aircraft is designed with ease of access and maintenance in mind.

The F-16 utilises a number of automatic, computer-controlled systems to maximise performance by physically changing the shape of the wings and control surfaces



Engine change on an F-16; both engine and airframe are designed for ease of replacement



Most parts of engine and avionics are easily accessible through exterior panels

ENGINE ★

The Falcon was originally fitted with the Pratt & Whitney F100-PW-200 afterburning turbofan, a development of the -100 that was built for the F-15 Eagle. Rated at 23,830lbf (106kN), the engine initially had reliability issues but subsequent developments of the -220 and -220E greatly improved it. Today, F-16s tend to have the General Electric F110-GE-12, rated at 29,388lbf (131.61kN) with afterburner, or the Pratt & Whitney F110-PW-229, rated at 29,160lbf (129.7kN) with afterburner.

The F-16's distinctive bubble canopy provides the pilot with excellent visibility



COCKPIT ★

One of the F-16's most distinctive features is the high bubble canopy. Frameless and reinforced to protect against bird strikes, the bulging sides combined with very high-set seat provide a 360° view, with a remarkable 40° down-view. The pilot's ejector seat is also set at a 30° angle, helping them cope with high-G manoeuvres. Primary flight controls are similarly adapted, with a side-mounted control column on the right and throttles on the left, both fitted with numerous other controls which the pilot might otherwise struggle to reach while under high-G.



Interior of an F-16 cockpit, with the side-mounted control column allowing easier control under high-G



Two USAF F-16s on patrol over Iraq, 2020

SERVICE HISTORY ★

Entering service with the USAF in 1978, the F-16 quickly spread around the world. It was used by the USAF over Iraq from 1991 onwards, and with the USAF and various European forces over the Balkans, Afghanistan and Libya. The type has also seen combat over the Pakistan-India border, Israel's borders, over Syria with the Turkish Air Force, and over the Sinai with the Egyptians, as well over Yemen with the Moroccan and Bahraini air forces. Easy to maintain, highly capable and now fully adapted for strike operations, the F-16 has proven an extremely popular and cost-effective force-multiplier for many nations around the globe.

The F-16 remains in production even after 50 years, and several Eastern European countries have either ordered or stated an intent to order them to replace their slightly younger Mikoyan MIG-29s. Ukraine is one of those countries, with the support of Britain, the Netherlands, Denmark and Belgium to train their pilots.



An Israeli F-16 takes off for a patrol over the Negev Desert, 2008

"EASY TO MAINTAIN, HIGHLY CAPABLE AND NOW FULLY ADAPTED FOR STRIKE OPERATIONS, THE F-16 HAS PROVEN AN EXTREMELY POPULAR AND COST-EFFECTIVE FORCE-MULTIPLIER FOR MANY NATIONS"

Royal Danish Air Force F-16 in low-level flight over California's Mojave Desert



An F-16 Fighting Falcon receives fuel from a KC-135 Stratotanker





FREEDOM AND THE FUTURE

Through **OFFENSIVE ACTION**, peacekeeping missions, and a continuing **VIGILANCE AGAINST AGGRESSION**, the Air Force has demonstrated capability and future awareness

★ WORDS: MICHAEL E HASKEW ★



Force was continually involved in active military campaigns, peacekeeping efforts and humanitarian endeavours.

At the same time, the Air Force has maintained and increased its advantages and competencies in regard to emerging technology. The Air Force of today and tomorrow is shaped by its experiences in both war and peace, and its achievements in recent years are nothing short of dazzling.

Since the end of the Gulf War, major combat deployment occurred during Operation Desert Fox, a four-day bombing campaign against Saddam Hussein's Iraq intended to diminish its capabilities to produce or deploy weapons of mass destruction. Meanwhile, no-fly zones were enforced in Operations Northern Watch and Southern Watch to prevent

Iraqi aircraft from mounting offensive air operations.

In 1999, the tinderbox of the Balkans was in turmoil, and the Air Force responded to orders during Operation Allied Force against Yugoslav forces during the Kosovo War. Operation Enduring Freedom, the global war against terror that began in 2001 and lasted at least 20 years, involved Air Force assets on a consistent basis, while the Air Force was instrumental in Operation Iraqi Freedom, which toppled Saddam Hussein from power in 2003 and sparked eight years of civil war and unrest. Operation Inherent Resolve employed Air Force assets in the defeat of the ISIS terrorist network in Syria and Iraq.

Humanitarian efforts have included deployments in Operation Provide Comfort, relief for Kurdish refugees in northern Iraq in 1991, Operation Restore Hope during the civil war in Somalia from 1992-95, Hurricane Katrina relief in 1995, and Air Force personnel committed to other natural disaster recovery across the globe.

Throughout the 21st century, the US Air Force has also stepped up its research and

development of existing and proven technology and weapons systems. Stealth, drone and Global Positioning System (GPS) capabilities have been enhanced with a new generation of improvements. Artificial Intelligence is presenting new frontiers in surveillance, reconnaissance, combat operations and situational awareness. Its possibilities are just beginning to be explored.

While combat efficiency and mitigating the risk of loss in lives and treasure remain focal points, the development of futuristic capabilities is ongoing. One example of this is the forthcoming Collaborative Combat Aircraft (CCA), a crewless aircraft that works in concert with crewed Air Force planes to act as a wingman in formation and to extend combat capabilities. Meanwhile, the B-21 Raider bomber, representing a new generation of stealth technology, is planned to enter service in the near future while the F-35 Lightning strike fighter, another state-of-the-art stealth combat aircraft, is already active.

All the while, the US Air Force remains focused on its mission of preparedness, ready for any military eventuality.

*The unmanned XQ-58A
Valkyrie aircraft flies during
a recent test of the latest
US Air Force technology in
the area of Collaborative
Combat Aircraft (CCA)*



*The Lockheed Martin F-35
Lightning stealth strike fighter
is already in service with the
US Air Force, representing
advanced technology*



*US Air Force F-16 fighters
prepare to take off from the
base in Saudi Arabia during
Operation Southern Watch*





OPERATION DESERT STORM

In early 1991, an American-led United Nations coalition ended Iraq's occupation of Kuwait during the Gulf War with one of the most **SUCCESSFUL MILITARY CAMPAIGNS** of the 20th century. The USAF were in the thick of battle

★ WORDS: TOM GARNER ★



Sometimes known as the '100-hour ground war', Operation Desert Storm was a short-lived but highly effective campaign that defeated Saddam Hussein's Iraqi army, air force and navy in just 43 days. Fought in Kuwait, Iraq, Saudi Arabia and the Persian Gulf, Operation Desert Storm aimed to liberate Kuwait from occupying Iraqi forces. Conducted by a large international coalition led by the United States, the operation swiftly achieved its aims against Iraq's armed forces with a skilful use of combined numerical and technological superiority.

INVASION OF KUWAIT

During 2-4 August 1990, Iraqi forces invaded the southern neighbouring country of Kuwait. At the beginning of the 1990s, Iraq had been ruled for over a decade by its president Saddam Hussein. An aggressive dictator who led the Arab nationalist Ba'ath Party, Hussein had already been embroiled in a long regional war against Iran and committed genocide against Kurds who lived in Iraq.

The war with Iran in particular had placed huge financial strain on the Iraqi economy, with the country being US \$14 million in debt to Kuwait. While the Kuwaitis demanded repayment, Hussein instead decided to occupy his neighbouring country to gain more control

over its rich oil supply. During the two-day invasion, the Iraqis militarily overwhelmed the Kuwaiti armed forces in an action that immediately caused regional instability with huge global implications.

With Kuwait under occupation, Iraq directly threatened the security of its other, much larger neighbour, Saudi Arabia. If Saudi Arabia was also annexed, Hussein would then be in control of 40 percent of the world's oil reserves. The occupation of Kuwait provoked an international outcry, with the United Nations immediately condemning the invasion and imposing economic sanctions on Iraq. The United States and United Kingdom also deployed soldiers and equipment to Saudi Arabia while encouraging

F-16A Fighting Falcon, F-15E Strike Eagle and F-15C Eagle fighter jets fly over Kuwait's burning oil fields

AirLand Battle

After their defeat in the Vietnam War, the US Army began to study ways to better realign their organisational capabilities in response to real-world conflicts. It also studied other contemporary conflicts, such as the 1973 Yom Kippur War, where speed and technologically advanced firepower could decide conflicts in just a few battles. A military doctrine was subsequently developed between 1982-89 called AirLand Battle that remains the US Army's basic doctrine for fighting wars.

AirLand Battle has four basic premises: 'Initiative', 'Agility', 'Depth' and 'Synchronisation'. 'Initiative' gives commanders the tactical edge in battle, with an emphasis on winning a war's first battle, even while being numerically outnumbered. 'Agility' is crucial for different forces to act faster than their enemy, while 'Depth' requires a battle's deeper forces (such as logistics) to support the closer elements of close-combat forces. Meanwhile, 'Synchronisation' is defined as synchronising forces to provide the highest amount of combat power at decisive moments. The doctrine was specifically developed for what was termed "mid-



American soldiers take the Oath of Allegiance to the US Army on top of a destroyed Iraqi tank, 27 February 1991

or high-intensity conflict", such as regional wars or defending NATO. It was effectively proved during the Gulf War, which was a regional conflict conducted by UN Coalition forces that were dominated by NATO allies. Desert Storm incorporated some of the key tenets of AirLand Battle. This included Coalition armoured forces winning large tank battles despite being outnumbered, closely coordinating air and naval attacks and conducting all operations with great speed and superior firepower.

other countries to contribute their own military support in the Persian Gulf.

DESERT SHIELD

The UN demanded that Iraq immediately withdraw from Kuwait but Hussein refused. A standoff then ensued while the Americans led a 'defensive mission' to prevent an Iraqi invasion of Saudi Arabia. Authorised by US President George HW Bush, this mission was codenamed Operation Desert Shield. American troops and air forces were deployed to the country at the invitation of King Fahd of Saudi Arabia in August 1990, and two US Navy battle groups sailed to the Persian Gulf. Over half-a-million American military personnel were

stationed in Saudi Arabia and the Persian Gulf while diplomatic tensions with Iraq continued to rise.

FORMING THE COALITION

In late November 1990, the UN Security Council issued Resolution 678 that ordered Iraq to withdraw from Kuwait by 15 January 1991. In the event of Hussein not complying with the Resolution, the UN decided to form a huge Coalition of allied nations that aimed to liberate Kuwait by force. This Coalition was dominated by the United States but included 36 countries. It consisted of almost one million military personnel and huge numbers of aircraft, tanks and ships.

The vast majority of the soldiers were American, with the United States providing almost 700,000 personnel. By contrast, the second- and third-largest contributing countries, Saudi Arabia and the United Kingdom, supplied 94,000 and 53,000 troops. Other countries included contingents from Egypt, France, Pakistan, Canada and the beleaguered Kuwait itself.

The Coalition consisted of a disparate array of partners. For example, Britain and Argentina had bitterly fought each other during the Falklands War in 1982 but they officially teamed up for the campaign. In contrast to the Americans, Denmark and New Zealand provided only 100 troops each, while Hungary

made the smallest contribution by deploying a team of 40 medics.

In 20th century terms, the Coalition was the largest military alliance of its kind since the Second World War. In an historic irony, it even included a German Luftwaffe squadron that offered logistical air support. This was the first time that the recently reunified Germany had undertaken a military role since 1945 but its small aerial contribution was highly symbolic in terms of the country's military reintroduction to world affairs.

Although the UN Coalition was huge, it faced Iraqi armed forces that had invaded Kuwait with 100,000 men. By January 1991, Hussein also ordered the mobilisation of all of Iraq's military reserves, which boosted its armed forces to over 600,000 soldiers. With this total, Iraq controlled what was then the world's fourth-largest army. Nevertheless, the UN Coalition remained numerically and technically superior in an alliance that was built upon global cooperation against a country that was internationally isolated.

DESERT STORM

By 15 January 1991, Hussein showed no sign of removing Iraqi forces from Kuwait and when the UN Resolution 678 deadline passed, the Coalition moved to implement what was codenamed Operation Desert Storm. Officially commencing on 17 January 1991, Desert Storm was simultaneously the UN move to liberate Kuwait and also an aerial bombing campaign against Iraq.

The day before Desert Storm began in earnest, President Bush addressed the American people: "Our objectives are clear: Saddam Hussein's forces will leave Kuwait.

American soldiers lead captured Iraqi soldiers away from the battlefield in Operation Desert Storm



The legitimate government of Kuwait will be restored to its rightful place and Kuwait will once again be free."

The campaign against Iraqi forces was initially an intense five-week bombardment of Iraqi military targets from air and sea. Coalition forces flew 100,000 aerial sorties and dropped almost 90,000 tons of bombs against Iraqi positions in both Kuwait and Iraq. Specifically, the Coalition's aim was to destroy the Iraqi Air Force, its anti-aircraft defences, command and communications facilities and other military targets such as Scud ballistic missile launchers. The Coalition was quickly able to gain air superiority over the numerically inferior Iraqi Air Force and by 23 February 1991 the ground offensive element of Desert Storm was ready to commence.

During the aerial bombing campaign, the largest Coalition bombardment was an airstrike known as Package Q. This saw 78 US Air Force aircraft attack several targets over the Iraqi capital of Baghdad, including a nuclear research centre. Meanwhile, Coalition naval forces destroyed the Iraqi Navy at sea in several engagements that saw the loss of over 100 Iraqi vessels, including 19 ships sunk.

GROUND OFFENSIVE

Despite the ferocity of the Coalition bombardments, Hussein remained defiant, and the day after Operation Desert Storm began he ordered the firing of missiles against Israel and Saudi Arabia.

These attacks resulted in no fatalities but the missile bombardments, particularly against

DESERT STORM

JANUARY-MARCH 1991

DEFINING MOMENT

AIR CAMPAIGN 17 JANUARY – 23 FEBRUARY 1991

Operating over Iraq and Kuwait, the Coalition conducts an intense aerial bombardment against Iraqi military targets. Primarily focusing on destroying the Iraqi Air Force, the Coalition aerial forces are mostly American but also feature contributions from the United Kingdom, Saudi Arabia, Canada, France and Italy. Their combined forces of almost 2,800 aircraft are able to achieve air superiority in one week. The Coalition loses 75 aircraft but destroys 254 Iraqi aircraft on the ground, with an additional 36 being shot down during air-to-air combat. Approximately 10,000-12,000 Iraqis are killed as a result of the air campaign compared to just 46 Coalition air personnel.

★ LIBERATION OF KUWAIT

The primary aim of Desert Storm's ground offensive is the liberation of Kuwait. With fighting occurring in both Kuwait and Iraq, the liberation only takes four days to achieve after seven months of Iraqi occupation.
24-28 FEBRUARY 1991

★ IRAQI MISSILE ATTACKS

Iraq launches 46 Scud ballistic missiles into Saudi Arabia against Coalition military targets and the capital Riyadh. Dozens of American soldiers are killed and many more wounded when a barracks is destroyed at Dhahran.
18 JANUARY – 26 FEBRUARY 1991

★ PACKAGE Q AIRSTRIKE

Package Q is the largest airstrike of the war with the US Air Force attacking a number of targets in Baghdad, including their main objective of the Tuwaltha Nuclear Research Centre. 78 American aircraft participate but they fail to destroy Tuwaltha.
19 JANUARY 1991

★ BATTLE OF BUBIYAN

The last and largest naval engagement of the war occurs off a Kuwaiti coastal island in the Persian Gulf. American, British and Canadian naval forces engage and destroy the remnants of the Iraqi Navy by sinking 21 vessels while suffering no losses.
29 JANUARY – 2 FEBRUARY 1991

★ AMIRIYAH SHELTER BOMBING

The US Air Force conducts a controversial bombing attack over Baghdad when an air raid shelter is hit by two laser-guided bombs. At least 408 Iraqi civilians are killed and many foreign governments condemn the attack.
13 FEBRUARY 1991



USS Missouri fires its 16in (406mm) guns at Iraqi targets along the northern Kuwaiti coast in the Persian Gulf, 6 February 1991

★ **DEFINING MOMENT**

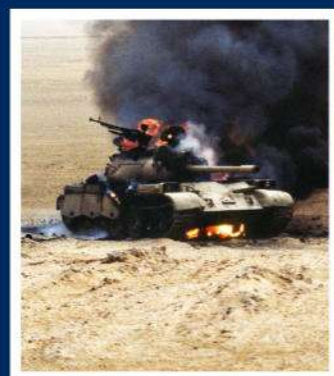
**HIGHWAY OF DEATH
25-27 FEBRUARY 1991**

After the withdrawal from Kuwait, Coalition aerial forces bomb thousands of retreating Iraqi soldiers and vehicles along a six-lane motorway called Highway 80. Running from Kuwait into southern Iraq towards Basra, Highway 80 becomes a scene of carnage, with the Coalition continuously carrying out bombing missions. A US Navy pilot describes the Iraqis as “basically just sitting ducks”, with the attack reaching a crescendo over a ten-hour period. By the end of the attack, hundreds of Iraqi soldiers are dead and over 2,000 of their vehicles are destroyed; 2,000 Iraqis are also captured while others escape into the surrounding desert.

★ **DEFINING MOMENT**

**BATTLE OF NORFOLK
27 FEBRUARY 1991**

Norfolk is the largest tank battle of the war, with dozens of American, British and Iraqi armoured divisions participating. A continuation of the Battle of 73 Easting, Norfolk sees the destruction of even more Iraqi tanks and armoured vehicles, along with the capture of thousands of troops. The British 1st Armoured Division performs particularly well. Primarily using Challenger 1 tanks, the British travel 217 miles (350km) in 97 hours and captured or destroy around 300 Iraqi tanks. A single Challenger 1 even destroys an Iraqi tank at a range of three miles (5km) – this is the longest-distance tank-to-tank kill in military history.



★ **BATTLE OF 73 EASTING**

One of several tank engagements that occur in Iraq during 26-27 February 1991, 73 Easting sees American and British armoured forces destroy hundreds of Iraqi tanks and other vehicles at minimal cost to themselves.
26-27 FEBRUARY 1991

★ **BATTLE OF KUWAIT INTERNATIONAL AIRPORT**

The largest tank battle in the history of the US Marines sees American forces seize control of Kuwait International Airport from Iraqi forces. The victory at the airport then enables the Americans to advance into Kuwait City.
27 FEBRUARY 1991

★ **CEASEFIRE**

US President George HW Bush declares a ceasefire after the liberation of Kuwait and the defeat of the Iraqi Army. President Bush makes his declaration during a live TV broadcast from the Oval Office in the White House.
28 FEBRUARY 1991

★ **BATTLE OF RUMAILA**

Two days after the ceasefire, US Army forces controversially attack a withdrawing column of Iraqi armoured forces in southern Iraq. The Iraqis suffer losses of over 700 killed, 3,000 captured and the destruction of hundreds of tanks and other armoured vehicles.
2 MARCH 1991

“THIS IS A VICTORY FOR THE UNITED NATIONS, FOR ALL MANKIND, FOR THE RULE OF LAW AND FOR WHAT IS RIGHT”

Israel, were politically charged. Several Arab nations, including Saudi Arabia, Egypt, Oman, Qatar and the United Arab Emirates were important members of the Coalition. However, they were also historically hostile to Israel. The Israelis were mindful of the importance of preserving the Coalition and so, despite their formidable military capabilities, they refrained from retaliating against Iraq.

Eleven days after attacking Israel, Saddam Hussein ordered an invasion of Saudi Arabia. On 29 January 1991, three Iraqi divisions occupied the coastal Saudi city of Khafji just south of the Kuwaiti border. It became the site of the first ground engagement of the Gulf War with a three-day battle occurring between Iraqi and Saudi-led Coalition forces. The Coalition forces recaptured Khafji by 1 February 1991, although Hussein attempted to turn the defeat into a propaganda victory. Around the same time as the battle for Khafji, the Coalition increased its attacks against Iraqi ground forces to prepare for a ground assault. This included Special Forces who began to conduct clandestine operations in Kuwait and Iraq. On 15 February 1991, the American Task Force 1-41 Infantry crossed the Saudi border into Iraq after a massive artillery bombardment. The Task Force began engaging with Iraqi ground forces two days later and quickly destroyed Iraq's artillery capabilities.

These American actions enabled Coalition forces to penetrate deeper into Iraq from 24 February but they were not immune to Iraqi counterattacks. On 25 February, a Scud missile hit a US Army barracks in Dhahran, Saudi Arabia that resulted in hundreds of casualties. Twenty-eight soldiers were killed with 260 more being wounded, including 110 hospitalisations.

This single missile attack accounted for more than one-third of all American soldiers killed during the war. The following day after the Scud attack, Hussein announced that Iraqi forces would withdraw from Kuwait but he did not renounce Iraq's claim over the country. Coalition aircraft, led by American, British and French aerial forces (along with accompanying tank fire) bombed a convoy of retreating Iraqi troops and vehicles on the same day. Occurring on a motorway called Highway 80 in southern Iraq, the Coalition destroyed thousands of Iraqi vehicles while inflicting thousands of casualties on Iraqi soldiers who were either killed, wounded or captured. The ruined road would later become known as the Highway of Death.

DESERT SABRE

At the same time as the destruction on Highway 80, the Coalition engaged in several battles against Iraqi forces in a subsidiary campaign of Desert Storm called Operation Desert Sabre. During 26-27 February, several Iraqi armoured divisions were defeated by

American and British forces at the Battle of 73 Easting. Named after a grid coordinate area in southeast Iraq, the battle saw hundreds of armoured vehicles engaging in the desert, although it was a very one-sided affair. For the loss of one tank, six killed and 19 wounded, the Coalition inflicted heavy losses on the Iraqis who suffered over 2,000 casualties and the loss of 420 vehicles, including 160 tanks.

Meanwhile, a tank battle also broke out on 27 February between American and Iraqi forces at Kuwait International Airport. Located almost ten miles (16km) south of Kuwait City, the battle was an engagement that was the largest tank battle in the history of the US Marines. It involved combined elements of 18 American and Iraqi divisions who fought to control access to the airport. While fighting was occurring at the airport, the US 1st and 2nd Marine Divisions met fierce Iraqi resistance as they entered Kuwait City. The Americans won the battle but the fighting resulted in severe damage to the airport and to important infrastructure in the Kuwaiti capital.

Shortly after 73 Easting and Kuwait International Airport, American and British forces again fought another tank engagement during 27-28 February in the southern Iraqi Al Muthanna Province in what became known as the Battle of Norfolk. Similar to 73 Easting, Norfolk was a codename for an objective that

included a road intersection, nearby desert trails and an Iraqi supply depot that was defended by armoured vehicles.

The order of battle for Norfolk was formidable. The US Army VII Corps consisted of four divisions (including two armoured divisions) and an artillery brigade, as well as the British 1st Armoured Division. Opposing them were large Iraqi forces that included eight divisions of armoured vehicles and infantry, along with four more armoured and mechanised brigades. The opposing sides created a combined total of thousands of tanks and soldiers, with Norfolk proving to be the largest tank battle of the First Gulf War.

Like 73 Easting, Norfolk was another one-sided engagement. The Americans and British incurred light casualties of 51 soldiers killed and over 137 wounded with the loss of only four tanks and seven Infantry Fighting Vehicles. By contrast, the Iraqis again suffered severe losses. Approximately 850 Iraqi tanks and hundreds of other vehicles were destroyed while over 7,000 soldiers were captured. Norfolk became the second-largest tank battle in American history after the Battle of the Bulge during the Second World War. It also turned out to be the final battle of the war.

“KUWAIT IS LIBERATED”

The results of these various battles that were fought simultaneously, or in quick succession, were the climactic engagements of Desert



US President George HW Bush gives a speech from the Oval Office in the White House following the decision to launch Operation Desert Storm

British engineers from the 7th Armoured Brigade detonate an Iraqi mine shield in the Saudi Arabian desert, 7 January 1991



Storm. The operation had resulted in the collapse of Iraqi military forces and, with the liberation of Kuwait City, Bush announced a ceasefire of hostilities on 27 February 1991.

Speaking to the American people on television, Bush declared: "Kuwait is liberated. Iraq's army is defeated. Our military objectives are met. Kuwait is once more in the hands of Kuwaitis, in control of their own destiny. We share in their joy, a joy tempered only by our compassion for their ordeal. Tonight, the Kuwaiti flag once again flies above the capital of a free and sovereign nation."

In the same address, Bush also acknowledged that Desert Storm's success was a collective effort: "Seven months ago, America and the world drew a line in the sand. We declared that the aggression against Kuwait would not stand. And tonight, America and the world have kept their word... No one country can claim this victory as its own. It was not only a victory for Kuwait but a victory for all the Coalition partners. This is a victory for the United Nations, for all mankind, for

the rule of law and for what is right." Bush's address came six weeks after the beginning of Desert Storm and on 28 February Iraq announced that it would accept all UN resolutions regarding the conflict.

A few days later, the Iraqis accepted the terms of a ceasefire agreement presented on 3 March by the Coalition commander US General Norman Schwarzkopf. One month later, the UN adopted Resolution 687 with terms that Iraq was expected to comply with after losing the war. A demilitarised zone and reinforced barrier was established along the Iraq-Kuwait border, with Hussein being forced to recognise Kuwait's independence. He was also required to return Kuwaiti property and end his programme for weapons of mass destruction. Nevertheless, despite his comprehensive defeat, Hussein remained in power until the American-led invasion of Iraq in 2003.

CASUALTIES

The detailed planning that went into

Operation Desert Shield meant that Operation Desert Storm resulted in relatively few casualties for the Coalition: 292 Coalition personnel (excluding Kuwaitis) were killed with a further 776 wounded. Kuwait suffered losses of 420 soldiers killed and 12,000 captured, while over 1,000 of the country's civilians also died. The human and material costs for Iraq were much greater. Estimates for its casualty figures vary but they range between at least 30,000 and as high as 100,000. Around 80,000-175,000 soldiers were captured with its armed forces also incurring the loss of over 3,000 tanks, 2,000 artillery pieces, 110 aircraft and dozens of ships. Iraqi civilians also suffered, with over 3,600 killed.

For the Coalition and particularly the USA, Desert Storm was an extremely successful campaign from a military perspective. On the 30th anniversary of the operation in 2021, it was described by the US General Accountability Office as "perhaps the most successful war fought in the 20th century".



*You may not see the plane,
but you'll see the bombs*

© Northrop Grumman



© Northrop Grumman

COMPOSITE MATERIALS

Any radar returns are reduced by the composite materials used, which further deflect any signals.

CREW COMPARTMENT

The B-2 carries two crew, a pilot and a mission commander with room for a third if needed.

FLY-BY-WIRE

The B-2's unique shape makes it unstable, and it relies on a computer to stabilise it and keep it flying.

WINDOWS

The B-2's windows have a fine wire mesh built into them, designed to scatter radar.

AIR INTAKES

To further reduce the B-2's signature, the engine intakes are sunk into the main body.

STEALTH BOMBER

The B-2 is extraordinary, both in terms of
APPEARANCE and **DESIGN**



he 'flying wing' shaped Stealth Bomber is a unique aircraft that was designed specially to make it as invisible as possible.

Its shape means there are few leading edges for radar to reflect from, reducing its signature. This is further enhanced by the composite materials from which the aircraft is constructed and the coatings on its surface. These are so successful that despite having a 172-foot wingspan, the B-2's radar signature is an astounding 0.1m².

The B-2's stealth capabilities, and aerodynamic shape, are further enhanced by the fact its engines are buried inside the wing. This means the induction fans at the front of the engines are concealed while the engine exhaust is minimised. As a result, the B-2's

thermal signature is kept to the bare minimum, making it harder for thermal sensors to detect the bomber as well as lowering the aircraft's acoustic footprint.

The design also means the B-2 is both highly aerodynamic and fuel efficient. The B-2's maximum range is 6,000 nautical miles and as a result the aircraft has often been used for long-range missions, some lasting 30 hours and in one case, 50. The B-2 is so highly automated that it's possible for a single crew member to fly while the other sleeps, uses the lavatory or prepares a hot meal and this combination of range and versatility has meant the aircraft has been used to research sleep cycles to improve crew performance on long-range missions. Despite this, the aircraft's success comes with a hefty price tag. Each

B-2 costs \$737 million and must be kept in a climate-controlled hangar to make sure the stealth materials remain intact and functional. These problems aside though, the Spirit is truly an astonishing aircraft, even if, chances are, you won't see one unless the pilots want you to...

*Not one you're likely to find
in your I-Spy book...*



GHOST WORKS:

Inside the Spirit

The B-2 is an unusual combination of complexity and elegance, the entire airframe built around the concept of stealth and focused on making the aircraft as hard to detect as possible

FLYING WING

The B-2's shape means it has very few leading edges, making it harder to detect on radar.

CARBON-REINFORCED PLASTIC

Special heat-resistant material near the exhausts mean the airframe absorbs very little heat, making it less detectable.

BOMB RACK ASSEMBLY (BRA)

The bomb rack assembly can hold a payload of up to 80 500lb bombs.

ENGINES

The B-2's four General Electric F118s don't have afterburners as the heat these generate would make the aircraft easier to detect.

ROTARY LAUNCH ASSEMBLY (RLA)

The RLA allows the B-2 to deploy different weapons in quick succession.

LANDING GEAR DOORS

The landing gear doors are hexagonal to further break up the B-2's radar profile.

© John Batchelor / www.johnbatchelor.com

THE STATISTICS... B-2 SPIRIT

MANUFACTURER: NORTHROP GRUMMAN

YEAR DEPLOYED: 1993

DIMENSIONS: LENGTH: 69FT, WINGSPAN: 172FT, HEIGHT: 17FT

WEIGHT EMPTY / MAX: 158,000LB / 336,500LB

UNIT COST: \$737,000,000

MAX SPEED: MACH 0.95 (604MPH)

PROPULSION: THE B-2 HAS GENERAL ELECTRIC F118-GE-100 NON-AFTERBURNING TURBOFANS

CEILING: 50,000FT

ARMAMENT DESCRIPTION: THE B-2 HAS TWO INTERNAL BAYS CAPABLE OF HOLDING 50,000LB OF ORDNANCE. COMMON

PAYLOADS OFTEN INCLUDE:

- 80 x 500LB CLASS BOMBS (MK-82) MOUNTED ON THE BOMB RACK ASSEMBLY OR BRA
- 36 x 750LB CBU CLASS BOMBS ON BRA
- 16 x 2,000LB CLASS WEAPONS (MK-84, JDAM-84, JDAM-102) MOUNTED ON THE ROTARY LAUNCHER ASSEMBLY RLA
- 16 x B61 OR B83 NUCLEAR WEAPONS ON THE RLA

Landings are fine, if the tower spots you coming...



The B-2's engines are buried within the wing



HEROES OF THE MEDAL OF HONOR



John A Chapman

High up on the mountain of Takur Ghar in Afghanistan, this soldier **BRAVELY FOUGHT** through mortal injury **TO SAVE THE LIVES** of over 20 men

★ WORDS: JACKSON VAN UDEN ★



President Trump presents John Chapman's Medal of Honor to Valerie Nessel, John's widow, in 2018



In August 2018, 16 years after John A Chapman's heroic last stand in Afghanistan, Valerie Nessel, his widow, stood in the East Room of the White House

surrounded by family members as they accepted Chapman's Medal of Honor. Upon the awarding of this medal, President Donald Trump remarked: "Our nation is rich with blessings, but our greatest blessings of all are the patriots like John... who... carry our freedom on their shoulders, march into the face of evil, and fight to their very last breath so that we can live in freedom, and safety, and peace."

Chapman was always known as a man who put others before himself, and it was in that spirit that he enlisted in the US Air Force on 27 September 1985, being assigned soon after as an information systems operator. However, he had always wanted to be a combat controller, and after four years behind a desk Chapman

volunteered to train as one, passing his courses in 1989 and later becoming an expert in immediate deployment and reconnaissance operations, among other roles. One of his trainers recalled that Chapman used to smirk during training as it was "too easy", and the trainer agreed that it was "too easy for John".

Secretary of the US Air Force Heather Wilson said in 2018: "John Chapman never talked about how good he was at what he did. He didn't have to." His ability to make difficult tasks look easy quickly led to his peers recognising him as one of the best in his field. In the late-1990s he went on a three-year tour in Okinawa, Japan, before being deployed to Afghanistan in 2002 as part of Operation Enduring Freedom. This was America's "necessary war of self-defence" after al-Qaeda, Ayman al-Zawahiri and Osama bin Laden's 9/11 terror attacks.

In the early hours of 4 March 2002, Chapman and his company, alongside Army Rangers and Navy SEALs, took part

Chapman pictured in early 2002, shortly after his deployment to Afghanistan



in Operation Anaconda, which formed part of the early days of the 'War on Terror' in Afghanistan. This mission aimed to establish reconnaissance outposts at Takur Ghar Mountain to monitor enemy activity in the surrounding valley, and to kill or capture al-Qaeda forces in the region. Taking Takur Ghar was of high strategic importance for the US as it would enable them control and oversight over a remote area that was a stronghold of both the Taliban and al-Qaeda.

US commanders concluded that due to the mountainous and remote nature of the area, and the potential threat from high-altitude enemy lookouts, a night-time approach via helicopter was the best option for Operation Anaconda. Chapman's superior, Brigadier General Davidson, recalls Chapman telling him when he heard about the operation: "Sir, this is the best Navy SEAL team they have, and they're about to head out. Because they'll get the hardest missions, they need the most experienced combat controller with them. I need to go with them."

So, on 4 March under the cover of darkness, the Navy SEAL team and Chapman made their way through the Zurmat region of Afghanistan, navigating around the Arma Mountains in US Army helicopter MH-47E. At around 2:45am the helicopter approached the top of Takur Ghar so the team could disembark and establish an outpost. However, unknown to the team, the enemy had already established their position at the top of the mountain, and the noise of



Chapman, a man who was renowned for always putting others before him, with an Afghan baby

the helicopter that reverberated around the valley and mountains had alerted them to the American forces' arrival.

As the helicopter began its descent to the top of Takur Ghar the night sky was lit up by gunfire and the flash of RPG rounds. An RPG round struck the helicopter's fuselage, seriously damaging the electrics and hydraulics. The crew realised they could not land due to

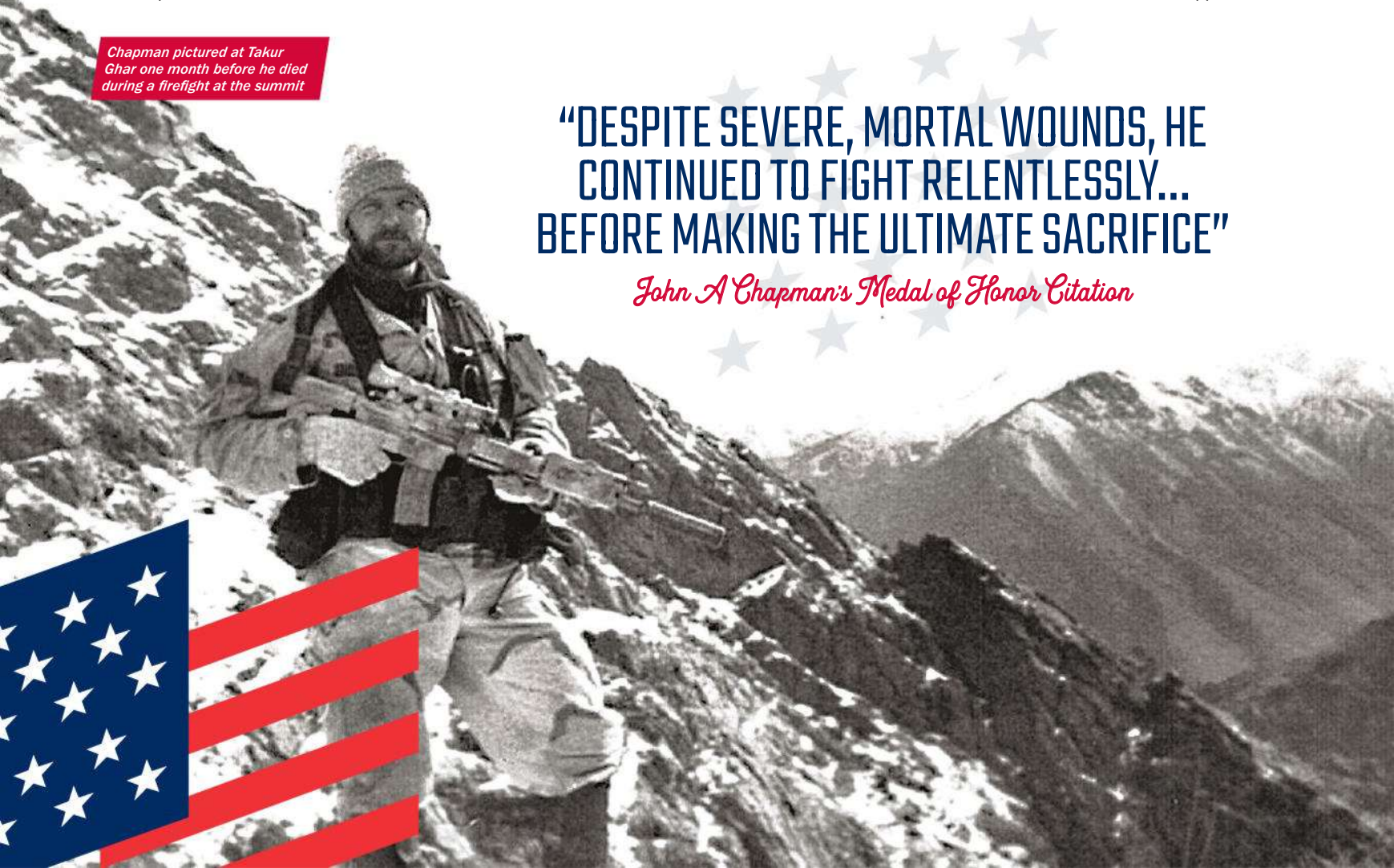
the incoming fire, so they began to ascend and withdraw. However, as the helicopter began its ascent, Navy SEAL Neil C Roberts, who was ready to disembark the vehicle, fell out into the snow on the mountain peak. The damaged helicopter completed a controlled emergency landing a few miles away. After landing, Chapman contacted a nearby AC-130 gunship and requested that it secure the area and help locate Roberts. He then co-ordinated a helicopter to extract the rest of the team. Chapman and some team members, including Navy SEAL Britt Slabinski, then volunteered to go back and rescue Roberts. Another helicopter dropped them off further up the mountain at around 4:57am, and they were immediately attacked as they waded their way through knee-high snow in a bid to rescue their lost comrade.

While heading uphill through the thick snow, Chapman moved ahead on his own, towards two enemy bunkers. Under fire, he charged and cleared the first bunker, enabling the rest of the men to enter safely as they secured Roberts, who by now had been fatally wounded by enemy fire. While the Americans regrouped, more al-Qaeda fighters from the second bunker began to rain down machine gun fire on them. Outnumbered, the US forces were in a desperate battle for survival. Several of them were wounded by grenades, and amid the constant battering by PKM machine guns Chapman was struck twice in the torso and he hit the floor. Believing Chapman to be dead, Slabinski called for uncontrolled air support

Chapman pictured at Takur Ghar one month before he died during a firefight at the summit

**"DESPITE SEVERE, MORTAL WOUNDS, HE
CONTINUED TO FIGHT RELENTLESSLY...
BEFORE MAKING THE ULTIMATE SACRIFICE"**

John A Chapman's Medal of Honor Citation





Chapman's Medal of Honor Plaque at Airmen's Heritage Park in San Antonio, Texas

from the nearby AC-130 and ordered his men to withdraw to a safer position further down the mountain, being forced to leave Chapman behind. The enemy onslaught was so violent, intense and unrelenting that the Americans suffered two more casualties as they withdrew.

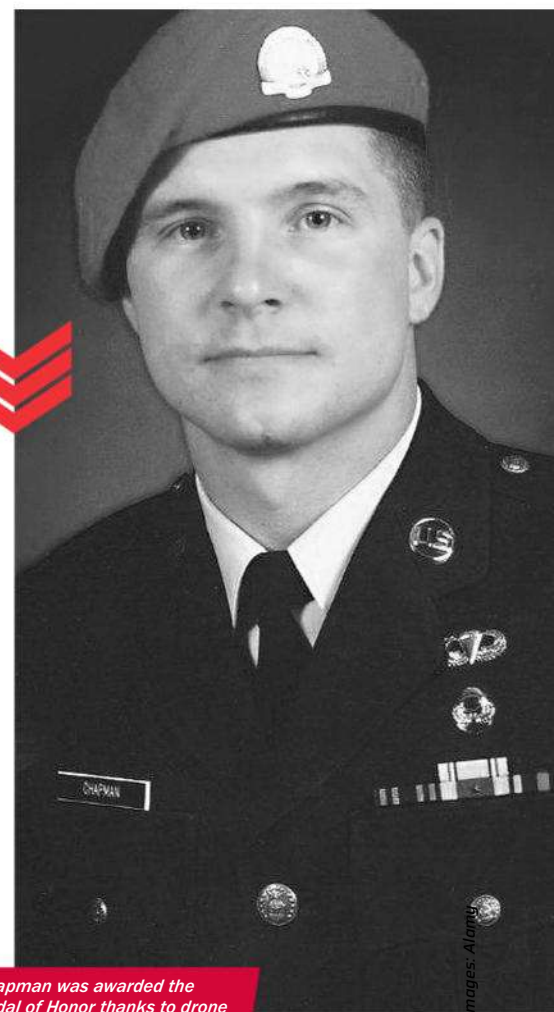
As 105mm howitzer rounds pounded Takur Ghar Mountain the seriously wounded Chapman, thought by his comrades to be dead, was still in the fight. At about 5:20am, despite being in shock and suffering severe blood loss, he once again began to engage the 24 al-Qaeda fighters. Chapman fought alone at the summit for nearly an hour, sustaining more injuries as he exchanged gunfire and engaged in hand-to-hand combat with his enemy.

Regarding these actions, Chapman's Medal of Honor Citation reads: "Despite severe, mortal wounds, he continued to fight relentlessly, sustaining a violent engagement with multiple enemy personnel before making the ultimate sacrifice." This ultimate sacrifice came at about 6am as another helicopter arrived at the summit. Aware of what awaited this helicopter if he hunkered down for safety, Chapman climbed out of the bunker he was in with the last of his strength and made his final stand to draw the enemy's attention away from the helicopter, perhaps aware that he was already dying. As the helicopter was hit and conducted a controlled landing, Chapman continued to provide covering fire as the men on board disembarked, and eventually after 16 bullet and shrapnel wounds Chapman was shot through the heart. His actions that day saved the lives of 23 men.

Chapman was posthumously awarded the Air Force Cross for his initial set of actions that

enabled the safe withdrawal of Slabinski and the rest of the rescue team, with the US Air Force remarking that "Sergeant Chapman reflected the highest credit upon himself and the United States Air Force". However, over ten years after Chapman was awarded the Air Force Cross, new technology enabled the US Air Force to enhance the video footage from the Predator drone that had recorded the Battle of Takur Ghar. This enhanced footage supported the evidence from his autopsy that he had not died in the first bunker and showed Chapman's valiant last stand to protect his comrades. Off the back of this new evidence, which is widely believed to be the first Medal of Honor actions ever recorded on video, the US Air Force pushed for Chapman to be posthumously awarded the United States' highest decoration for valour.

Chapman and his actions were recognised at the White House on 22 August 2018, with Chapman becoming the first airman to be awarded the Medal of Honor since the Vietnam War. The following day US Air Force leaders gathered at the Pentagon as Chapman was inducted into the Hall of Heroes. Chief Master Sergeant of the Air Force Kaleth Wright, Chief of Staff General Dave Goldfein and Secretary of the Air Force Heather Wilson all spoke about Chapman and his heroism, invoking ancient Greek ideas of character and telling stories from his childhood. Wilson finished with perhaps the most profound remark: "For his generation of Americans, John Chapman was the answer to that lingering question. Our nation endures, and continues to be the land of the free because of brave men. Because of John Chapman."



Chapman was awarded the Medal of Honor thanks to drone footage of the deadly battle



RAPID DRAGON

'Fat Albert' is on the offensive: how a lumbering **1950S CARGO TRANSPORTER** may become the **WORLD'S MOST LETHAL** air arsenal



The rules of air combat are undergoing significant changes, with fighters, drones and even transport aircraft all being evaluated and developed to increase their offensive potential. While much of the wider mainstream media has focused on the vastly expensive development of a new sixth-generation fighter, the latest buzzwords among US aerospace manufacturers are 'persistence', 'long-range', 'aerial denial' and 'cost' – not all of which will be feasible in the current development of a high-end fighter aircraft. A host of aerospace concepts are quietly being developed and evaluated, many of which look set to change the way the United States conducts its next large-scale 'near-peer' air war, which many analysts believe will be against China over Taiwan and the vast distances of the Pacific.

These changes could see the large, slow Lockheed Martin C-130 Hercules, nicknamed

the 'Fat Albert' by crews and maintenance staff, take on an offensive strike role well outside China's potent weapon engagement zone (WEZ) the country is expected to establish with any invasion of Taiwan. The C-130s will be tasked with disrupting China's military maritime supply lines in the Pacific.

The US Air Force Special Operations Command (AFSOC) has a long history of utilising the capabilities of the C-130 Hercules well beyond the role of a simple 'trash hauler', as any cargo aircraft is jokingly termed. In Vietnam, specialised AC-130 Gunships caused destruction along the Ho Chi Minh Trail against North Vietnamese supply convoys at night. More recently, dedicated low-altitude 'nap of the earth flying' MC-130 variants insert and extract Special Forces teams deep behind enemy lines.

The ongoing development of Lockheed Martin's basic C-130 airframe has led to the deployment of the C-130J in service with air forces worldwide (the US possesses the largest fleet). The enhancements to the airframe,

engines and performance have enabled the US to further extend the offensive capabilities of the C-130, transforming it into a persistent long-range stand-off cruise missile platform capable of launching strikes with multiple warheads to saturate several ground targets or decimate an enemy's naval fleet in a single strike. All of this can be achieved with a standard C-130J, requiring no significant modifications or upgrades to the airframe.



The aircraft is capable of far more than just supply drops

A Royal Australian Air Force C-130 deploys flares



It's a capability that's proven impossible for the US Air Force (USAF) to resist, prompting the swift establishment of the Rapid Dragon programme in 2020. The USAF's Air Mobility Command (AMC), which manages most of America's C-130J fleet, took a leading role alongside the AFSOC and the Air Strategic Development Planning and Experimentation (SDPE), part of the Air Force Research Laboratory (AFRL). Rapid Dragon uses two air-dropped pallets to deploy 12 cruise missiles or other munitions currently under development.

The first test of the system took place in 2021 and, after minor technical adjustments, again in 2022. The trials involved an MC-130J from the 352nd Special Operations Wing (SOW) air-dropping a Rapid Dragon deployment system containing long-range cruise missiles, which were released shortly afterwards over a range above the Norwegian Sea. Yet the USAF was well aware that the programme had far greater potential than simply a pallet of missiles being pulled out of the back of a C-130 by parachute.

Rapid Dragon initially concentrated on adapting the Lockheed Martin AG-158B Joint Air-to-Surface Missile (JASSM), enabling command-and-control testing for retargeting if needed in flight, owing to the high-altitude nature of the air drops. After the successful test drops, AMC Commander US General Mike

Minhan told the media that he was "keen to see the Rapid Dragon capability included in everything the command does in the future, simply due to the dilemmas it could create for any potential enemy".

With US transports operating well behind a layered air defence system and a stated range of nearly 1,000 miles (1,600km) for the JASSM AGM-158, a C-130 could operate well beyond enemy defences, such as those of China, and deploy palletised munitions in salvos. This tactic effectively turns any transport aircraft the US currently operates into an airborne cruise missile platform at minimal additional cost. A simple roll-on, roll-off pallet containing a six-pack of JASSMs is all that's needed, with targeting data already loaded. If required, an onboard specialist crew member can update the target data during flight via a straightforward computer attached to the pallet.

With constant defence budget pressure, this system means a C-130 can serve as an air-launch JASSM platform in the morning and be transporting cargo in the afternoon, without any airframe modifications. However, the cost of a single JASSM missile and Lockheed Martin's inability to meet the USAF's production demands are affecting the Rapid Dragon development programme. The solution might be to switch to Anduril Industries' Barracuda-M

cruise missiles as a more affordable alternative. According to the company, the Barracuda-500 was mainly developed for use with Rapid Dragon to supplement the JASSM when required. By the end of 2025, the USAF expects Rapid Dragon to be part of its extensive, highly autonomous first-strike capability involving air, land and sea assets.

US defence planners already have a potential strategic scenario in mind for the programme, where a fleet of USAF C-130s loaded with JASSM and Barracuda pallets over the Pacific can target multiple objectives simultaneously, from ground installations to warships, due to the large number of missiles launched in one strike. This plan would effectively turn parts of the Pacific Ocean into a no-go zone for the Chinese, especially if the US offers the Rapid Dragon system to Japan, which already operates C-130s.

Rapid Dragon could become one of the most cost-effective strike capabilities the US has deployed so far in the Pacific region and other areas if needed. It's also important to remember that C-130s will be a much more discreet attack platform when operating from overseas locations before any strike. Externally, nothing on the aircraft will reveal its offensive capabilities; it could easily pass as a 'standard' USAF cargo aircraft to observers.

Images: Alamy

HISTORY OF THE UNITED STATES AIR FORCE

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MEET THE AIRMEN WHO DARED THE
FIRST COMBAT MISSIONS



MILITARY MISSIONS
GET THE INSIDE STORIES OF THE
USA'S DEADLIEST OPERATIONS



HI-TECH INNOVATION
DISCOVER THE TECHNOLOGIES THAT
MAKE THE USAF THE BEST